Fruits &
Its Health Benefits

Editors

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Preface

Fruits are mainly consumed as a fresh and also processed into different type of products. Basically fruits contain micronutrients like vitamins, minerals, and also rich source of water, so fruits have many health benefits against different types of diseases. The main focus of fruit consumption is the role of fibers and poly phenolic compounds that act as a neutraceutical to reduce risk of chronic diseases. The natural antioxidants present in fruits helps in preventing ageing process, cancer risk, reduce LDL level, help to reduce heart stroke etc. Apart from these, the minerals present in fruits help to prevent kidney stones, reduced blood pressure, defend against oxidative stress and viral infections. Fruits are store house of phytochemicals, which are diverse, bioactive secondary metabolites of plants that comprise an essential part of human diet and are considerable because of their biological properties. As per APEDA, India is the largest producers of fruits in the world and is known as basket of world. The major fruits grown in India are mangoes, grapes, apple, apricots, orange, banana, avocado, guava, litchi, papaya, strawberry, dates, sapota and watermelon. India produces about 30 million tones of fruits but contribute only 9% of total calorie intake in the country. USDA’s My plate encourages making half your plate fruits and vegetables for healthy eating. While health benefits of fruits is the subject of many books and other publication, the purpose of book is to deliver detailed information about nutritional value, therapeutic value and potential health benefits of different types of fruits to understand the role of fruits on health in better way. In this book the chapters are written by dominant author (s) and follow a consistent style. There are 2 chapters in this book, and the chapters provide a comprehensive review of the chapter title.

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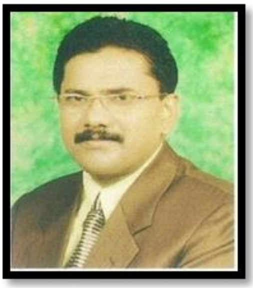
Dr. John David



Prof. (Dr.) John David is a vibrant senior university Professor in Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Allahabad (INDIA), in the field of Food and Dairy Technology, having a teaching and research experience of 32 years. Presently he is serving as Head, Department of Dairy Technology and Dean in Warner College of Dairy Technology (SHUATS). He is a passionate research worker having more than 201 research publications in his credit. Prof. David already supervised 70 M.Sc. / M.Tech. and 12 Ph.D. theses. He is a First Class post graduate in Dairy Technology, Seed Technology and Business Administration. He has a flair for writing technical books and already written 10 books of national and international repute in the field of Food and Dairy Technology. Prof. David participated in many national and international conferences in USA, CHINA, FRANCE, AUSTRALIA and presented research papers. He is an expert in Human Resource Management too. Prof. David is a regular examiner in number of universities namely, Allahabad Central University, Benaras Hindu University (BHU), PUSA Agricultural University, Indira Gandhi Agricultural University, Bihar Agricultural University, Chitrakoot University, U.P. Rajarshi Tandon University etc. An orator having proficiency in 10 different languages and a Versatile Speaker for Food and Dairy Technology in All India Radio and Television (Door Darshan) programmes. He is a life member of several professional bodies like, IDA, DTSI, BRS, AGRO-BIOS, Intensive Agriculture and Progressive Research Journal etc. He is a prolific writer and several of his articles appeared in Hindustan Times, Times of India and other Indian dailies. Prof. David held many posts of recognition like Registrar, Dean, Head, Chairman, Editor and Research Coordinator in several committees of university. He is an International Speaker for Food-Nutrition & Obesity and presented papers at different international platform in USA & other countries. Prof. David is Editorial Board Member of International journal of Food Engineering and Journal of Modern Agricultural Science & Technology, NEW YORK. He has been bestowed with Young Scientist Award in the year 2006 for his excellent research in the field of Food and Dairy Technology. In the year 2014, he has been honoured with" National Pride" (Rashtriya Gaurav) and "Gem of Education" (Shiksha Ratan) award. In the year 2015, he has been awarded with "Best Educationist"," Golden Citizen"," National Pride of Education" (Rashtriya Vidya Gaurav) and "Bharat Vidya Vibhushan" award for his distinguished service to the nation in educational field. He has been awarded as “BEST TEACHER” by Indian Council of Agricultural Research (ICAR) in 2014-15. Prof. David has delivered special lecture as KEYNOTE SPEAKER for International conference on Nutraceuticals and Food Sciences,2018 at PARIS (FRANCE).

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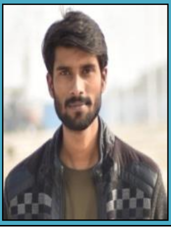
14. Mr. Praveen Sharma 	Health benefits of watermelon.	M.Sc. (continue) Food Technology Warner College of Dairy Technology SHUATS, Prayagraj, U.P.

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Chapter - 1

Introduction of Fruits

Souvik Tewari

Fruit make up a large portion of our diets. The botanical definition of fruit is a seed-bearing part of a flowering plant or tree that can be eaten as food. By those standards, foods such as avocados, cucumbers, squash, and also tomatoes are all fruits. From a culinary viewpoint, a fruit is usually thought of as any sweet tasting plant product with seeds, whereas a vegetable is any savory or less sweet-tasting plant. As the ovary develops into a fruit, its wall often thickens and becomes differentiated into three, more or less distinct, layers. The three layers together form the pericarp, which surrounds the developing seed or seeds.

The Three Fruit Layers Are

- **Exocarp:** The outermost layer often consisting of only the epidermis
- **Mesocarp:** Or middle layer, which varies in thickness
- **Endocarp:** Which shows considerable variation from one species to another

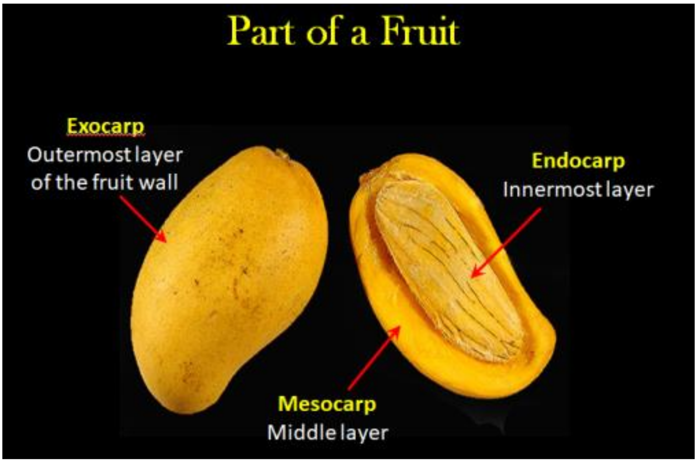


Fig 1: Three Fruit Layers of Fruit

Classification of Fruits

On the basis of the number of ovaries and the number of flowers involved in their formation, all fruits may be classified into three major groups. The following outline includes most of the common types of fruits.

A) Simple Fruits

Simple fruits develop from a single matured ovary in a single flower.

1. **Fleshy Fruits:** Pericarp Fleshy at Maturity

   a) **Berry:** consisting of one or more carpels with one or more seeds, the ovary wall fleshy. Like grapes.

   Pepo: (an accessory fruit), a berry with a hard rind, the receptacle partially or completely enclosing the ovary. Like: Cucumber, Watermelon.

   Hesperidium: a specialized berry with a leathery rind. Like: Citrus fruits (lime, lemon, mandarin, orange, grapefruit)

   b) **Drupe a Stone Fruit:** derived from a single carpel and containing one seed.

   Exocarp a thin skin. Like: Mango, Peach, Coconut

   c) **Pome:** (an accessory fruit), derived from several carpels, receptacle and outer portion of pericarp fleshy, inner portion of pericarp papery or cartilaginous, forming a core. Like: Apple and Pear

   d) **Hip:** (an accessory fruit), several separate carpels enclosed within the fleshy or semi-fleshy receptacle. Like: Strawberry

Fruits that develop from tissues surrounding the ovary are called accessory fruits. Accessory fruits generally develop from flowers that have inferior ovaries and the receptacle or hypanthium becomes a part of the fruit. Accessory fruits can be simple, aggregate or multiple fruits

2. **Dry Fruits:** Pericarp Dries at Maturity

a) **Dehiscent Fruits:** Those which dehisce or split open when fully mature

- **Follicle:** composed of one carpel and splitting along a single suture
- **Legume:** composed of a single carpel and splitting along two sutures
- **Capsule:** composed of several carpels and opening at maturity in one of four ways:
    - Along the line of carpel union (septicidal dehiscence)
    - Along the middle of each carpel (loculicidal dehiscence)
    - By pores at the top of each carpel (poricidal dehiscence)
    - Along a circular, horizontal line (circumscissle dehiscence)
- **Silique:** composed of two carpels which separate at maturity, leaving a persistent partition between them

b) **Indehiscent Fruits:** those which do not split open at maturity

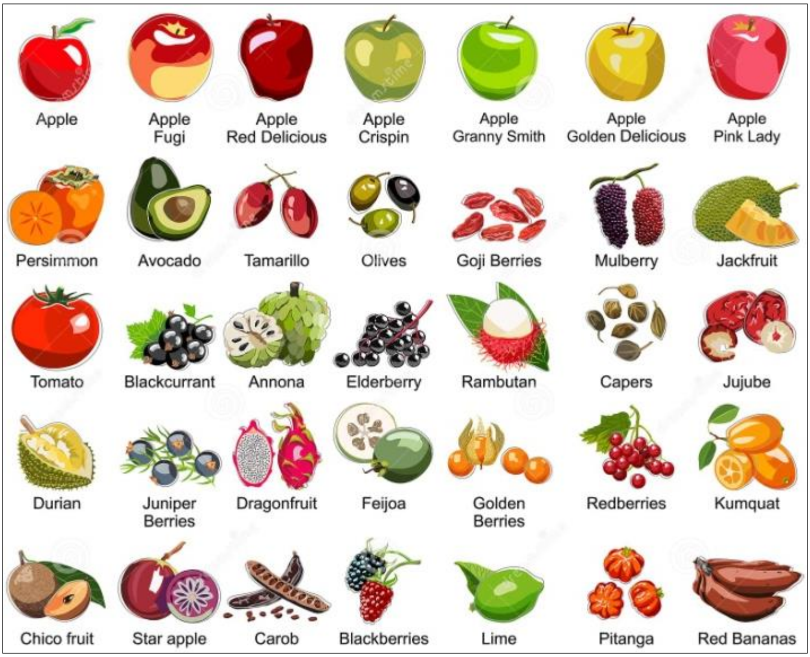
- **Achene or Akene:** a one-seeded fruit with the seed attached to the fruit at one point only
- **Caryopsis or Grain:** a one-seeded fruit in which the seed is firmly attached to the fruit at all possible points
- **Samara:** a one- or two-seeded fruit with the pericarp bearing a wing like outgrowth.
- **Schizocarp:** Consisting of two carpels which at maturity separate along the midline into two one-seeded halves, each of which is indehiscent.
- **Loment:** Having several seeds, breaking into one-seeded segments at maturity.
- **Nut:** A hard, one-seeded fruit, generally formed from a compound ovary, with the pericarp hard throughout.

B) Aggregate Fruits

Aggregate fruits consist of a number of matured ovaries formed in a single flower and arranged over the surface of a single receptacle. Individual ovaries are called fruitlets.

C) Multiple Fruits

Multiple fruits consist of the matured ovaries of several too many flowers more or less united into a mass. Multiple fruits are almost invariably accessory fruits. Like: Pineapple, Mulberry and Jackfruit.



Source: Internet

Fig 2: Types of Fruits

Nutritional Value

Nutritional value of the fruits mainly depends upon the types of fruits. Basically fresh fruits are generally high in fiber, vitamin C, and water. Regular consumption of fruit is generally associated with reduced risks of several diseases and functional declines associated with aging.

Uses of Fruits

Many hundreds of fruits, including fleshy fruits (like apple, kiwifruit, mango, peach, pear, and watermelon) are commercially valuable as human food, eaten both fresh and as jams, marmalade and other preserves. Fruits are also used in manufactured foods (e.g., cakes, cookies, ice cream, muffins, or yogurt) or beverages, such as fruit juices (e.g., apple juice, grape juice, or orange juice) or alcoholic beverages (e.g., brandy, fruit beer, or wine). Fruits are also used for gift giving, e.g., in the form of Fruit Baskets and Fruit Bouquets.

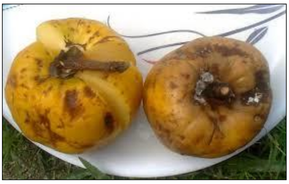
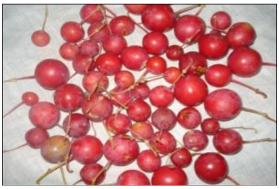
Nonfood Uses

Fruits are Also Used for Non-Food Using Purpose. Like

- Bayberry fruits provide a wax often used to make candles.
- Many dry fruits are used as decorations or in dried flower arrangements (e.g., annual honesty, cotoneaster, lotus, milkweed, unicorn plant, and wheat). Ornamental trees and shrubs are often cultivated for their colorful fruits, including beautyberry, cotoneaster, holly, pyracantha, skimmia, and viburnum.
- Fruits of opium poppy are the source of opium, which contains the drugs codeine and morphine, as well as the biologically inactive chemical theabaine from which the drug oxycodone is synthesized.
- Osage orange fruits are used to repel cockroaches.
- Many fruits provide natural dyes (e.g., cherry, mulberry, sumac, and walnut).
- Dried gourds are used as bird houses, cups, decorations, dishes, musical instruments, and water jugs.
- Pumpkins are carved into Jack-o'-lanterns for Halloween.
- The spiny fruit of burdock or cocklebur inspired the invention of Velcro.
- Coir fiber from coconut shells is used for brushes, doormats, floor tiles, insulation, mattresses, sacking, and as a growing medium for container plants. The shell of the coconut fruit is used to make bird houses, bowls, cups, musical instruments, and souvenir heads.
- Fruit is often a subject of still life paintings.

Tribal Fruits in India

Table 1: List of tribal fruits in India

Name	Image	Place	Source of Image
1. Custard apple		West Bengal, Orissa & Maharashtra	Internet
2. Mahua fruit		Orissa, West Bengal	Orissa-Tribes Stock-Photos& Orissa-Tribes Stock-Images-Alamy
3. Kokum		Karnataka& Maharashtra	Hormazd mehta-posted-on-february 23, 2017
4. Bwigri		Kokrajhar district of Assam	Wild edible fruits of Kokrajhar district of Assam, North-East India
5. Star fruits		West Bengal, Orissa	Internet
6. Ker or kair-berry		Rajasthan	Internet

7. Duku fruits		Rajasthan	Internet
8. Ramphal		Maharashtra	Internet
8. Kiwi fruits		Arunachal Pradesh & Assam	Internet
9. Blood fruits		Andaman	Internet

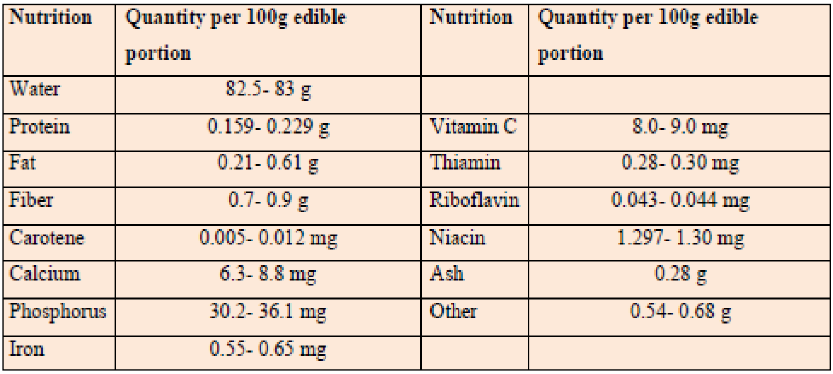
Exotic Fruit

Dragon Fruit

Information about Dragon Fruit

In recent years, dragon fruit has been increasingly popular in all over the world. Dragon fruit a recently introduced super fruit in Indian market. It is basically tropical fruit. People have more curiosity about its taste and unique look. Dragon fruit grows on the Hylocereus cactus, also known as the Honolulu queen, whose flowers only open at night. The plant is native to southern Mexico and Central America. Now it is grown all over the world. It has many names, including pitaya, pitahaya, and strawberry pear. The two most common types have bright red skin with green scales that resemble a dragon, hence the name. The most widely available variety has white pulp with black seeds, though a less common type with red pulp and black seeds exists as well. Another variety referred to as yellow dragon fruit has yellow skin and white pulp with black seeds. Dragon fruit may look exotic, but its flavors are similar to other fruits. Its taste has been described as a slightly sweet cross between a kiwi and a pear.

Nutrition Facts



Nutrition	Quantity per 100g edible portion	Nutrition	Quantity per 100g edible portion
Water	82.5- 83 g		
Protein	0.159- 0.229 g	Vitamin C	8.0- 9.0 mg
Fat	0.21- 0.61 g	Thiamin	0.28- 0.30 mg
Fiber	0.7- 0.9 g	Riboflavin	0.043- 0.044 mg
Carotene	0.005- 0.012 mg	Niacin	1.297- 1.30 mg
Calcium	6.3- 8.8 mg	Ash	0.28 g
Phosphorus	30.2- 36.1 mg	Other	0.54- 0.68 g
Iron	0.55- 0.65 mg		

Table 2: Nutrition Facts of Dragon Fruit

Dragon fruit contains small amounts of several nutrients. It is also a rich source of iron, magnesium, and fiber.

Contain high amount of fiber and magnesium, as well as the extremely low calorie content, dragon fruit can be considered a highly nutrient dense fruit.

Provides Several Antioxidants

Dragon fruit contains various types of antioxidants. that protect the cells from unstable molecules called free radicals, which are linked to chronic diseases and aging.

These are some of the main antioxidants contained in dragon fruit pulp.

- **Betalains:** Found in the pulp of red dragon fruit, these deep red pigments have been shown to protect “bad” LDL cholesterol from becoming oxidized or damaged.

- **Hydroxycinnamates:** This group of compounds has demonstrated anticancer activity in test-tube and animal studies.
- **Flavonoids:** This large, diverse group of antioxidants is linked to better brain health and a reduced risk of heart disease.

Potential Health Benefits

- Both red and white varieties of dragon fruit help to reduce insulin resistance and fatty liver in obese person.
- Dragon fruit contains prebiotic fiber that promotes the growth of beneficial bacteria in our gut potentially improving metabolic health.
- This fruit also helps to improve certain features of metabolic syndrome. (type 2 diabetes)

Conclusion

Dragon fruit is a tropical fruit native to Mexico and Central America. Its taste is like a combination of a kiwi and a pear. Dragon fruit is a low-calorie fruit that is high in fiber and provides a good amount of several vitamins and minerals. Animal studies suggest that dragon fruit may improve insulin resistance, liver fat, and heart health. However, the results of human studies are inconsistent.

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Chapter - 2

Health Benefits of Pineapple

Sudip Kumar Das

Introduction

Pineapple is a wonderful tropical fruit having exceptional juiciness, vibrant tropical flavour and immense health benefits. Pineapple contains considerable calcium, potassium, fibre, and vitamin C. It is low in fat and cholesterol. Vitamin C is the body's primary water soluble antioxidant, against free radicals that attack and damage normal cells. It is also a good source of vitamin B1, vitamin B6, copper and dietary fibre. Pineapple is a digestive aid and a natural Anti-Inflammatory fruit.

A group of sulfur-containing proteolytic (protein digesting) enzymes (bromelain) in pineapple aid digestion. Fresh pineapples are rich in bromelain used for tenderizing meat. Bromelain has demonstrated significant anti-inflammatory effects, reducing swelling in inflammatory conditions such as acute sinusitis, sore throat, arthritis and gout and speeding recovery from injuries and surgery. Pineapple enzymes have been used with success to treat rheumatoid arthritis and to speed tissue repair as a result of injuries, diabetic ulcers and general surgery. Pineapple reduces blood clotting and helps remove plaque from arterial walls. Studies suggest that pineapple enzymes may improve circulation in those with narrowed arteries, such as angina sufferers. Pineapples are used to help cure bronquitis and throat infections. It is efficient in the treatment of arterioscleroses and anaemia. Pineapple is an excellent cerebral toner; it combats loss of memory, sadness and melancholy. Pineapple fruits are primarily used in three segments, namely, fresh fruit, canning and juice concentrate with characteristic requirements of size, shape, colour, aroma and flavour.

➢ **Nutrition Facts**

The nutrition facts for raw pineapple

Table 1: Nutrition facts of raw pineapple

Amt per Serving (100gm)
Calories 82
Total Fat 0g
Cholesterol 0mg
Sodium 2mg
Potassium 120mg
Total Carbohydrate 15g
Dietary Fiber 2g
Sugars 11g
Protein 1g

➢ **Health Benefits of Pineapple**

Eating fruits and vegetables of all types has long been associated with a reduced risk of many lifestyle-related health conditions. Many studies have suggested that increasing consumption of plant foods like pineapples decreases the risk of obesity, overall mortality, diabetes, and heart disease. It also promotes a healthy complexion and hair, increased energy, and an overall lower weight. The following are possible benefits of eating pineapple.

- **Age-Related Macular Degeneration**

In one prospective study from 2004, people who ate 3 or more servings per day of all fruits demonstrated a decreased risk and slowed progression of age-related macular degeneration.

- **Asthma Prevention**

The risks of developing asthma are lower in people who consume a high amount of certain nutrients. One of these nutrients is beta-carotene. It is found in orange, yellow and dark green plant foods, such as pineapple, mangoes, papaya, apricots, broccoli, cantaloupe, pumpkin, and carrots. Some smaller studies have suggested bromelain can also contribute to reducing asthma symptoms.

- **Blood Pressure**

Increasing potassium intake by consuming high potassium fruits and vegetables can help with lowering blood pressure. According to the National Health and Nutrition Examination Survey (NHANES), fewer than 2 percent of U.S. adults meet the daily 4,700-mg recommendation. A high potassium intake is associated with a 20 percent decreased risk of dying from all causes.

- **Cancer**

As an excellent source of vitamin C, a strong antioxidant, pineapples can help combat the formation of free radicals. These are linked to the development of cancer. High fiber intake from all fruits and vegetables is associated with a lowered risk of colorectal cancer.

- **Diabetes**

Individuals with type 1 diabetes who consume high-fiber diets tend to have lower blood glucose levels, and individuals with type 2 diabetes may have improved blood sugar, lipids, and insulin levels. One medium pineapple provides about 13 g of fiber. The Dietary Guidelines for Americans recommends 21 to 25 g per day for women and between 30 and 38 g per day for men.

- **Its Enzymes Can Ease Digestion**

Pineapples, because of their fiber and water content, help to prevent constipation and promote regularity and a healthy digestive tract. Pineapples are also rich in bromelain, an enzyme that helps the body digest proteins. Bromelain also reduces inflammatory immune cells, called cytokines that damage the digestive tract lining. The inedible stems are the most concentrated source of bromelain, which can be extracted and is readily available in supplement form. Pineapples contain a group of digestive enzymes known as bromelain. They function as proteases, which break down protein molecules into their building blocks, such as amino acids and small peptides. Once protein molecules are broken down, they are more easily absorbed across the small intestine. This can be especially helpful for people with pancreatic insufficiency, a condition in which the pancreas cannot make enough digestive. Bromelain is also widely used as a commercial meat tenderizer due to its ability to break down tough meat proteins.

- **Fertility**

Antioxidant-rich diets have been shown to improve fertility. Because free radicals can damage the reproductive system, foods with high antioxidant activity like pineapples are recommended for those trying to conceive. The antioxidants in pineapple, such as vitamin C and beta-carotene, and the vitamins and minerals copper, zinc, and folate have properties that affect both male and female fertility.

- **Healing and Inflammation**

Some studies have shown that bromelain, primarily in the stem, can reduce swelling, bruising, healing time, and pain associated with injury and surgical intervention.

- **Heart Health**

The fiber, potassium, and vitamin C content in pineapple all promote heart health. In one study, people who consumed 4,069 mg of potassium per day reduced the risk of death from ischemic heart disease 49 percent when compared with those who consumed less potassium. Researchers link high potassium intakes to a reduced risk of stroke, protection against loss of muscle mass, preservation of bone mineral density, and reduction in the formation of kidney stones.

- **Skin**

The antioxidant vitamin C, when eaten in its natural form or applied topically, can help to fight skin damage caused by the sun and pollution, reduce wrinkles, and improve overall skin texture. Vitamin C also plays a vital role in the formation of collagen, the support system of the skin.

- **Antioxidant Protection and Immune Support of Pineapple**

Vitamin C is the body's primary water-soluble antioxidant, defending all aqueous areas of the body against free radicals that attack and damage normal cells. Free radicals have been shown to promote the artery plaque build-up of atherosclerosis and diabetic heart disease, cause the airway spasm that leads to asthma attacks, damage the cells of the colon so they become colon cancer cells, and contribute to the joint pain and disability seen in osteoarthritis and rheumatoid arthritis. This would explain why diets rich in vitamin C have been shown to be useful for preventing or reducing the severity of all of these conditions. In addition, vitamin C is vital for the proper function of the immune system, making it a nutrient to turn to for the prevention of recurrent ear infections, colds, and flu.

May Ease Symptoms of Arthritis

Arthritis affects over 54 million adults in the US alone. There are many types of arthritis, but most of them involve inflammation in the joints. Since pineapples contain bromelain, which has anti-inflammatory properties, it’s commonly thought that they may provide pain relief for those with inflammatory arthritis. In fact, research from as early as the 1960s shows that bromelain was used to relieve symptoms of rheumatoid arthritis, a type of arthritis that involves inflammation of the joints. Several recent studies have looked into the effectiveness of bromelain for treating arthritis. Bromelain helped relieve pain as effectively as common arthritis medicines like diclofenac. However, it’s not clear if bromelain can be a long-term treatment for arthritis symptoms. Longer studies are needed before recommending bromelain to relieve arthritis symptoms.

- **May Speed Recovery after Surgery or Strenuous Exercise**

Eating pineapples may reduce the time it takes to recover from surgery or exercise. This is largely due to the anti-inflammatory properties of bromelain. Bromelain may reduce the inflammation, swelling, bruising and pain that often occurs after surgery. It also seems to reduce markers of inflammation. Proteases like bromelain are believed to speed up the recovery of damage caused by strenuous exercise by reducing inflammation around the damaged muscle tissue.

Conclusion

Pineapple is rich source of antioxidants, that helps to reduce the risk of chronic diseases such as heart disease, diabetes and certain cancers. Many of the antioxidants in pineapple are bound, so they may have longer lasting effects. Pineapples contain bromelain, a group of digestive enzymes that breaks down proteins. This may aid digestion, especially in those with pancreatic insufficiency. Pineapple contains compounds that reduce oxidative stress and inflammation, both of which are linked to cancer. One of these compounds is the enzyme bromelain, which may stimulate cell death in certain cancer cells and aid white blood cell function. Pineapples have anti-inflammatory properties that may boost the immune system. The anti-inflammatory properties of pineapple may provide short-term symptom relief for people with common types of arthritis. The bromelain in pineapples may reduce the inflammation, swelling, bruising and pain that occur after surgery. Bromelain’s anti-inflammatory properties may also aid recovery after strenuous exercise by reducing tissue inflammation.

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Chapter - 3

Health Benefits of Date Fruit

D.B. Shinde

Introduction

Date fruit is not only a nourishing fruit that can be preserved, stored, and carried easily over long distances, especially in dry climates, but date palm also provides a suitable place for the settling of nomadic people by creating shade and protecting against desert winds. Date palm is one of the oldest plants cultivated by human beings and has been used as food for 6000 years. It is a particularly important product in arid and semi-arid regions of the world and plays an important role in the economic and political life of the people in these regions. Many products, including date syrup, alcohol, animal feed, date powder, different types of bread, marmalade, sweet candy, chocolate, date paste, and others, can be obtained from date. Not only does date palm have an effective role in the ecosystem of the desert, but it has several agricultural and animal husbandry uses. Other parts of the date palm are also important in the agricultural economy. For example, the stem is used for making boats, covering the roof of rural houses, paper and wood industries, and making fibre. The foliage is used for making handicrafts like fans and straw hats. World date production based on FAO statistics through

1999 Iran was the largest producer of dates in the world. From 2000 to 2007, however, Egypt was the largest producer of dates and Iran was third after Iraq in 2000 and 2001. From 2002 to 2007, Iran had the second rank in date production with Iraq third rank. The largest consumer and importer of date in the world is Asia. Among the countries of the Asian continent, China and India are major importers of date. In the European Union, France and Germany have the first and second rank of importing date, respectively. In North America, the United States is the major importer of date, followed by Canada.

Date palm is one of the oldest plants, with a 7000-year-old history. The earliest planting of date palm was coincident with the oldest civilizations and extended from northeast Africa to northwest of the Tigris and Euphrates plateau. Phoenicians promoted the planting of date palm around Mediterranean regions in ancient times. Due to the transfer of date from Phoenicia region to Mediterranean regions, Greeks call it Phoenix.

Human beings carried the plant with them as a major product during emigration and promoted its use and cultivation. The fact that dates is a major supply of energy and is preferable for a long time is responsible for the random spread of date. Soldiers during military expeditions, merchants and excavators all were engaged in scattering and spreading the plant by throwing away date pits after eating the fruit.

Several thousand cultivars of date have been identified throughout the world, having some commercial importance. Though some of them are unique to a particular country, the top cultivars are grown extensively around the world. In western countries, date is known as a dessert rather than staple food. Of four imported cultivars grown commercially in the US, three fourths of the cultivated area is under Deglet Noor cultivation and 10% under the remaining three cultivars, Zahidi, Khadrawy, and Halawy. Since the cultivar Deglet Noor (which literally means the date of the light or translucent seedling) is large in size and has light color, delicate flavor, and considerable shelf life during storage, it is more popular than other cultivars. Date palm is resistant to bad climatic conditions and is able to endure a wide range of temperature (from –6 to 50°C). It is also resistant to the salinity of water and soil. Hot, dry climates and limited rainfall is most appropriate climate for this plant.

The date palm *(Phoenix dactylifera)* belongs to the Arecaceae (or palmae) family and consists of three parts: (1) flesh with thin crust, (2) date pit, and (3) cap. It has been planted for many years in the semi-arid and desert areas of the Middle East, Pakistan, and India; in California, USA, in the Canary Islands, and in the northern African countries for fuel, shade, fiber, and as building material. Regarding texture, dates are classified into three groups as soft (Eg., Barhi, Halawy, Khadrawi, and Medjhool), semi-dry (Eg., Dayri, Deglet Nour, and Zahidi), and dry dates (Eg., Thoory). Date texture depends on the amount of pectin methylation; the lower the amount of methylation, the softer the date. Tamer date is the softest (39% methylation) and kimri date is the toughest (72% methylation). Moisture and fiber content are also expected to play a role in determining whether a date is soft, semi-dry or dry. Throughout this section, they were use the word "date" to refer to the fleshy part of the fruit. Date, which is very sweet, comprises about 50–88% of the total weight according to cultivar, stage of ripening, and water content. Sugars make up about two thirds of date flesh with water about one fifth. The rest of date weight includes protein, fat, crude fiber, minerals, different vitamins (especially vitamin B), tannins, and many other components. Date has much nutritive value and can play an effective role in providing the nutritional needs of humans. Each kilogram of fresh date contains approximately 1570 calories of energy, whereas dry date contains more than 3000 calories per kg. The date (*Phoenix dactylifera*) is considered to be the most important fruit tree in most of the Arabian countries (Mustafa *et al.*, 1983). In the gulf region and the United Arab Emirates (UAE) in particular, the date was, before the discovery of oil, the main source of food together with camel milk and fish. Even today, in spite of the dramatic socio-economic changes in the UAE, dates continue to play an essential role in the diet of the local inhabitants. The date palm starts to produce fruits at an average age of 5 years, and continues production with an average yield of 400-600 kg/tree/year for up to 60 years (Shinwari 1993). Each fruit is a one-seeded berry consisting of a fleshy mesocarp covered by a thin epicarp; a hard endocarp surrounds the seed, and these stones (pits) are often used as an animal feed. The fruits are arranged on spikelets bearing 20-60 individual dates, and a number of such spikelets are attached to a central stalk to form a bunch (5-30 bunches per tree). Some fruits ripen early in the season, whilst others are not mature until the end of the season (August/September), and the mature fruits can vary widely in their organoleptic, physical and chemical characteristics (Dowson, 1982). All edible varieties of date pass through four distinct stages of ripening and, in the UAE, the To whom all correspondence should be addressed Arabic terms Kimri, Khalal, Rutab and Tamr are used to represent, respectively, the immature green, the mature full coloured, the soft brown and the hard raisin like stages of development. Dates are commonly consumed as fresh, short shelf life fruits at the Khalal and Rutab stages, or they may be left to dry to the low moisture, Tamer stage characterised by its good storability. In addition, Dowson (1982) recounted the usage of the Kimri stage by poor people, usually after the fruits had been beaten with sticks to remove the astringent juice. Besides the direct consumption of the fruit, dates are utilised locally in many ways, including the production of date extract and syrup and the preparation of fruit cakes and salami-like rolls. Moreover, the utilization of dates in modern industries has been reported by many workers. Dates also contain thiamine, riboflavin, niacin, and pantothenic acid. These vitamins and minerals help the body to produce haemoglobin, which is a protein in red blood cells that binds to oxygen and carries oxygen from the lungs to tissues. Potassium is an essential mineral that the body needs to maintain proper muscle contractions including contractions of the heart muscle. Potassium also promotes a healthy nervous system and efficient metabolism in the body. One serving of date contains 31 grams of carbohydrates that supplies the body with large amounts of energy. A date is one of the best and choicest foods of the nature and is the treasure house of highly soluble natural iron, calcium, potassium and other vitamins. Date contain dietary fibers, vitamins like B1, B2, C, folic acid and nicotinic acid in good amount. Date has less fat content hence heart patients also consume as such or their products. Dates are high in dietary fibers, low in fat, cholesterol and sodium and it contain more potassium. This is one of the best healthful combinations. The National Cancer Institute recommends that the low fat and high fiber diet help to reduce the risk of some type of cancers. Dates contain high amount of dietary fiber. This fiber helps to control the diabetes by decreasing the blood glucose levels and helps to lower the blood cholesterol level. The enzymatic methods simulate more or less the conditions prevalent in human gastrointestinal tract for reflecting the fate of food, including its fiber components. Dates contain 75 gm of carbohydrates, making them a powerhouse of energy. Carbohydrates include sugars such as fructose, glucose, sucrose to provide a quick energy and are readily used by the body. Dates perfect energy source. Today’s healthy diets recommended that eating foods that are low in sodium, fat, cholesterol and high in fiber. Hence, Dates fit perfectly into the healthy lifestyle.

➢ Composition of Dried Dates

Table 1: Chemical Composition of Dried dates.

Constituents	Amounts
Moisture (%)	15.3
Protein (gm)	2.5
Fat (gm)	0.4

Minerals (gm)	2.1
Crude fiber (gm)	3.9
Carbohydrates (gm)	75.8
Energy (Kcal)	317
Calcium (mg)	120
Phosphorus (mg)	50
Iron (mg)	7.3

Health Benefits of Date Fruit

Dates are the fruit of the date palm tree, which is grown in many tropical regions of the world. Dates have become quite popular in recent years. Almost all dates sold in Western countries are dried. Depending on the variety, fresh dates are fairly small in size and range in color from bright red to bright yellow. Medjool and Deglet Noor dates are the most commonly consumed varieties. Dates are chewy with a sweet flavor. They are also high in some important nutrients and have a variety of advantages and uses.

Very Nutritious

Dates have an excellent nutrition profile. Since they’re dried, their calorie content is higher than most fresh fruit. The calorie content of dates is similar to that of other dried fruits, such as raisins and figs. Most of the calories in dates come from carbs. The rest are from a very small amount of protein. Despite their calories, dates contain some important vitamins and minerals in addition to a significant amount of fiber.

A 3.5-Ounce (100-Gram) Serving Provides the Following Nutrients

- Calories: 277
- Carbs: 75 grams
- Fiber: 7 grams
- Protein: 2 grams
- Potassium: 20% of the RDI
- Magnesium: 14% of the RDI
- Copper: 18% of the RDI
- Manganese: 15% of the RDI
- Iron: 5% of the RDI
- Vitamin B6: 12% of the RDI

Health Benefits of Dates

High in Fiber

Getting enough fiber is important for overall health. With almost 7 grams of fiber in a 3.5-ounce serving, including dates in your diet is a great way to increase your fiber intake. Fiber can benefit your digestive health by preventing constipation. It promotes regular bowel movements by contributing to the formation of stool. In one study, 21 people who consumed 7 dates per day for 21 days experienced improvements in stool frequency and had a significant increase in bowel movements compared to when they did not eat dates Furthermore, the fiber in dates may be beneficial for blood sugar control. Fiber slows digestion and may help prevent blood sugar levels from spiking too high after eating. For this reason, dates have a low glycemic index (GI), which measures how quickly your blood sugar rises after eating a certain food.

High in Disease-Fighting Antioxidants

Dates provide various antioxidants that have a number of health benefits to offer, including a reduced risk of several diseases. Antioxidants protect your cells from free radicals, which are unstable molecules that may cause harmful reactions in your body and lead to disease. Compared to similar types of fruit, such as figs and dried plums, dates appear to have the highest antioxidant content. Here’s an overview of the three most potent antioxidants in dates:

- **Flavonoids:** Flavonoids are powerful antioxidants that may help reduce inflammation and have been studied for their potential to reduce the risk of diabetes, Alzheimer's disease and certain types of cancer.
- **Carotenoids:** Carotenoids are proven to promote heart health and may also reduce the risk of eye-related disorders, such as macular degeneration.
- **Phenolic Acid:** Known for its anti-inflammatory properties, phenolic acid may help lower the risk of cancer and heart disease.

Promote Brain Health

Eating dates may help improve brain function. Laboratory studies have found dates to be helpful for lowering inflammatory markers, such as interleukin 6 (IL-6), in the brain. High levels of IL-6 are associated with a higher risk of neurodegenerative diseases like Alzheimer’s. Additionally, animal studies have shown dates to be helpful for reducing the activity of amyloid beta proteins, which can form plaques in the brain. When plaques accumulate in the brain, they may disturb communication between brain cells, which can ultimately lead to brain cell death and Alzheimer's disease. One animal study found that mice fed food mixed with dates had significantly better memory and learning ability, as well as less anxiety-related behaviors, compared to those that did not eat them. The potential brain-boosting properties of dates have been attributed to their content of antioxidants known to reduce inflammation, including flavonoids. However, human studies are needed to confirm the role of dates in brain health.

- **Promote Natural Labor**

Dates have been studied for their potential to promote and ease late-term labor in pregnant women. Eating these fruits throughout the last few weeks of pregnancy may promote cervical dilation and lower the need for induced labor. They may also be helpful for reducing labor time. In one study, 69 women who consumed 6 dates per day for 4 weeks prior to their due date were 20% more likely to go into labor naturally and were in labor for significantly less time than those who did not eat them. Another study of 154 pregnant women found that those who ate dates were much less likely to be induced compared to those who did not.

A third study found similar results in 91 pregnant women who consumed 70–76 grams of dates daily starting the 37th week of pregnancy. They were in active labor for an average of 4 fewer hours than those who did not eat dates. Although eating dates appears to help promote labor and reduce labor duration, more research is needed to confirm these effects. The role dates may have in pregnancy is likely due to compounds that bind to oxytocin receptors and appear to mimic the effects of oxytocin in the body. Oxytocin is a hormone that causes labor contractions during childbirth. Additionally, dates contain tannins, which are compounds that have been shown to help facilitate contractions. They are also a good source of natural sugar and calories, which are necessary to maintain energy levels during labor.

- **Excellent Natural Sweetener**

Dates are a source of fructose, which is a natural type of sugar found in fruit. For this reason, dates are very sweet and also have a subtle caramel-like taste. They make a great healthy substitute for white sugar in recipes due to the nutrients, fiber and antioxidants that they provide. The best way to substitute dates for white sugar is to make date paste, as in this recipe. It is made by mixing dates with water in a blender. A rule of thumb is to replace sugar with date paste at a 1:1 ratio. For example, if the recipe calls for 1 cup of sugar, you'll replace it with 1 cup of date paste. It is important to note that although dates are high in fiber and nutrients, they are still fairly high in calories and best consumed in moderation.

Other Potential Health Benefits

Dates have been claimed to have a few other health benefits that have not yet been extensively studied.

- **Bone Health:** Dates contain several minerals, including phosphorus, potassium, calcium and magnesium. All of these have been studied for their potential to prevent bone-related conditions like osteoporosis.
- **Blood Sugar Control:** Dates have the potential to help with blood sugar regulation due to their low glycemic index, fiber and antioxidants. Thus, eating them may benefit diabetes management. Although these potential health benefits are promising, more human studies are needed before conclusions can be made.

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Chapter - 4

Indian Blackberry (*Syzygium cumini*): Its Medicinal Properties and Therapeutic Benefits for Human

Souvik Tewari

Introduction

Indian Blackberry is commonly known as jambolan, Java plum, black plum or jamun, is an evergreen tropical tree in the flowering plant family Myrtaceae. It is native to the Indian Subcontinent, adjoining regions of Southeast Asia, China and Queensland. The name of the fruit is sometimes mistranslated as blackberry. It is mostly use for traditional treatment for diabetes mellitus, inflammation, ulcers and diarrhoea. It has pharmaceuticals properties and it is a good source of anthocyanin, effectives against the analgesic properties. It also has chemopreventive, radioprotective and antineoplastic properties. The present article describes briefly on the information on medicinal value of Indian blackberry on human health.

Chemical Composition of Indian Blackberry

The fruits pulp contain phytochemicals like malieic acid, oxalic acid, gallic acid, tannins, cynidin glycoside, oleanolic acid, flavonoids, essential oils and betulinic acid. The pulp of the jamun contains anthocyanins, delphinidin, petunidin, malvidin-diglucosides. Fruits are rich in glucose, fructose, citric acid, malic acid, gallic acid, delphinidin-3- gentiobioside, malvidin-3-laminaribioside, petunidin-3-gentiobioside, cyaniding diglycoside.

Nutritional Importance and Composition of Indian Blackberry

- The Indian blackberry provides lower calories as compared to other fruit; a medium sized jamun gives about 3 to 4 calories.
- The fruit is rich in carbohydrates and proteins.
- Glucose and fructose are the principal sugars present in the ripe fruit, with no trace of sucrose.
- It is a fairly good source of iron as it provides about 1-2 mg per 100 grams.
- It is an excellent source of vitamin C; this black plum provides 18 milligrams of vitamin C per hundred grams. (The daily adult requirement of this vitamin is 40 mg).
- Calcium is found in trace amount.
- Jamun is a rich source of folate.
- Vitamin B, magnesium, potassium, fiber, carotene and phytochemicals (anti-oxidants) are also available in large amount.
- The stem & bark contains tannin, gallic acid, resin, phytosterols.
- Research confirms that polyphenolic compounds have far-reaching health benefits including prevention of several chronic diseases like cancer, heart ailments, diabetes, ageing and arthritis.
- The seed contains the glycoside, jamboline, gallic acid and essential oils.
- The leaves contain essential oils.
- The flower contains terpenoids.

Table 1: Nutritional composition of Indian Blackberry

Java Plum, raw - Nutritional value per 100 g
Energy 60 kcal
Carbohydrates 15.56 g
Fat 0.23 g
Protein 0.72 g
Water 83.13 g

Vitamin A 3 IU
Thiamine (vit. B1) 0.006 mg (1%)
Riboflavin (vit. B2) 0.012 mg (1%)
Niacin (vit. B3) 0.260 mg (2%)
Pantothenic acid (B5) 0.160 mg (3%)
Vitamin B6 0.038 mg (3%)
Vitamin C 14.3 mg (17%)
Calcium 19 mg (2%)
Iron 0.19 mg (1%)
Magnesium 15 mg (4%)
Phosphorus 17 mg (2%)
Potassium 79 mg (2%)
Sodium 14 mg (1%)

Source: USDA Nutrient Database

Medicinal Properties

The jamun basically recognized as a folk medicine and pharmaceutical trade than in any other field. Medicinally, the fruit is revealed to be astringent, stomachic, carminative, antiscorbutic and diuretic. Additionally, a fruit extract pretend antimicrobial and cytotoxic activities and may potentially be used on typical antimicrobial products. In comparison to other non- traditional fruits jamun showed considerable high antioxidant flavonols. Fruits contain many different kinds of anti-oxidant compounds, including flavonoids, phenolics, carotenoids and vitamins, which are all considered beneficial to human health, for decreasing the risk of degenerative diseases by reduction of oxidative stress, and for the inhibition of macromolecular oxidation activity, which can constituent such as anthocyanins, tannins and flavonols.

Nutrition Information

Blackberries Offer Many Health Benefits, Including

- Good source of vitamins and minerals like C, K, and Manganese
- Rich in fiber
- May boost brain health

- **Good Source of Vitamin C**

One cup of raw blackberries has 30.2 milligrams of vitamin C. That’s half the daily recommended value. Vitamin C is integral to collagen formation in bones, connective tissue, and blood vessels. Vitamin C may also help the following function.

- Healing wounds
- Regenerate the skin
- Battle free radicals (molecules released by toxins) in the body
- Absorption iron
- Shorten the common cold
- Prevent scurvy

Vitamin C helps reduce the formation of cancer causing substances in the body. Vitamin C acts as an antioxidant which may also reduce oxidative stress in the body that can lead to cancer.

2. Rich in High Dietary Fibre

Blackberry also rich in high dietary fibre. A low-fibre diet has been linked to digestive problems like bloating, constipation, and stomach pain. A high-fibre diet may help to reduce cholesterol, promote regular bowel movements, control blood sugar levels by slowing the rate of sugar absorption ad provide fuel to nourish healthy gut bacteria.

3. Great Source of Vitamin K

Vitamin K also plays a role in bone metabolism. Vitamin K deficiency may lead to bone thinning and bone fractures. It may cause easy bruising, heavy menstrual bleeding, and blood in the stool or in the urine. One cup of raw blackberries provides almost 29 micrograms over one-third of the daily recommended value of vitamin K.

4. High in Manganese

Manganese may help prevent osteoporosis, manage blood sugar levels, and reduce epileptic seizures. One cup of raw blackberries contains 0.9 milligrams of manganese, almost half the daily recommended value. Keep in mind though that too much manganese may be toxic.

5. May Boost Brain Health

Blackberries may improve brain health and help prevent memory loss caused by aging, according to a review of research in the Journal of Agricultural and Food Chemistry. The review concluded that antioxidants in berry fruits help fight free radicals and alter how brain neurons communicate. This may help reduce brain inflammation, which can lead to cognitive and motor issues common with aging.

Therapeutic Benefits of Blackberries

Blackberries are sweet and delicious fruit that is immensely beneficial for maintaining good health. They are a helpful resource to fight and prevent various disease conditions, which are as follows:

- **Against Cancer**

Blackberries being rich in phenolic compounds such as ellagic acids and having a high content of flavonoids such as anthocyanins possess anti-carcinogenic properties. Due to their antioxidant nature, they help damage the free radicals present in the body, thus preventing the root cause of cancer development. Blackberries are found to be effective against various types of cancers such as lung cancer, colon cancer, skin cancer and esophageal cancer among others. Also, high quantities of various micro-nutrients and vitamins prevent the development of tumors and inhibit the growth of cancerous cells. This property of protection against oxidative damage is vital in the cure of many other diseases.

- **Curing Neural Dysfunctions**

Researchers have found that regular consumption of blackberries help in improving memory and also curing different neural dysfunctions. It helps in improving the cognitive functions of the body through the polyphenolic compounds that are present in it.

- **Impaired Digestion**

High content of fiber and various vitamins in blackberries contribute to better digestive health. It contains both soluble and insoluble fiber that ensures better absorption of water, minerals and nutrients in the intestines, thereby improving the digestive functions altogeter.

- **Reduce Risk of Cardiovascular Anomalies**

Regular intake of blackberries makes the functioning of the heart better. Due to the high amount of anthocyanins, it extends great antioxidant properties that reduce the risk of cardiovascular diseases. It also contains dietary fiber and magnesium in large quantities that prevent the blockage of blood vessels and allow unimpaired blood flow, thereby reducing the possibility of getting heart stroke and cardiac arrhythmia. Also high content of Vitamin C helps in lowering the risk of many heart-related problems.

- **Against Bacterial and Viral Infections**

Attributing to the substantial contents of phytoestrogens, vitamins and minerals blackberries have great efficiency in fighting various bacterial and viral infections. Presence of ellagic acids also contributes to its anti-pathogenic activities. Thus, blackberries help in improving and enhancing the immunity of the body and protect it from various microbial infections.

- **Controling Obesity**

Blackberries are high in fiber content as well as low in sugar and cholesterol. Such a nutrient profile of blackberries makes them efficient weight controllers. Eat a cup of it as a regular snack or make a salad for a healthy weight control regime.

- **Against Skin Aging**

Various skin conditioning nutrients like Vitamin C, A, K and E present in blackberries give bright and rejuvenated skin. Vitamin C helps to keep skin tight and toned by strengthening and protecting the collagen from damaging. Vitamin E present in blackberries keep skin glowing and prevents skin from wrinkles and other oxidative damage. Also, the tannins present in blackberry leaves could be used as natural astringent on wounds that help in blood clotting.

- **Improving Eye Health**

Blackberries play a vital role in improving eye health. The vitamins present in it, especially Vitamin A, protect eyes from diseases like cataract and night blindness; it enhances vision and keeps eyes healthy. Blackberries also consist of lutein which protects against the harmful ultraviolet rays and prevents eye damage.

- **For Pregnancy and Women Health**

Due to its high nutrition parameters, blackberries are very beneficial to pregnant and lactating women. Folic acid and other vital micronutrients are important to be included in the diet during pregnancy. These vitamins and minerals are abundantly present in blackberries that help in the formation and growth of tissues and reduce the risk of birth defects. It also boosts immunity and strengthens bones keeping the expecting mother healthy and infection free. Also, phytoestrogens present in blackberries help in relief from PMS and menopause-related symptoms.

- **Controlling Diabetes**

Blackberries are low on sugar content plus their high fiber nature makes them apt for sugar management in the body. The high fiber contributes to even sugar absorption while maintaining the proper digestive function. This keeps absorption of sugars balanced, which in turn controls sugar levels and the potassium present in blackberries regulates insulin levels in the body thus keeping diabetes away.

Food Uses

- Good quality jamun juice is excellent for sherbet, syrup and “squash”. In India the latter is a bottled drink prepared by cooking the crushed fruits for 5 to 10 minutes at 140°F, pressing out the juice, combining it with sugar and water and adding citric acid and sodium benzoate as a preservative.
- Jamuns of good size and quality, having a sweet or sub acid flavor and a minimum of astringency, are enjoyable raw and may be made into tarts sauces and jam.
- Astringent fruits are improved in palatability by soaking them in salt water or pricking them, rubbing them with a little salt, and letting them stand for an hour.
- All but decidedly inferior fruits can be utilized for juice which is often com-parable to grape juice.
- When extracting juice from cooked jamuns, it is recommended that it be allowed to drain out without squeezing the fruit and it will thus be less as tringent.
- The white-fleshed jamun has adequate pectin and makes a very stiff jelly unless cooking is brief.
- The more common purple fleshed yields richly colored jelly but are deficient in pectin and require the addition of a commercial jelling agent or must be com-bined with pectin-rich fruits such as unripe or sour guavas.
- In Goa jamun are an important source of wine, resembling Port.
- Brandy and distilled liquor called “jambava” have also been made from the fermented fruit.
- Jamun vinegar, extensively made throughout India, is an attractive, clear purple, with a pleasant aroma and mild flavor.

Conclusion

Jamun is traditionally used for the treatment of various diseases specially diabetes and related complications. Jamun Is also used for breast cancer prevention because jamun have antineoplastic activity. The effect of Jamun and its phytochemicals should also be investigated for its chemopreventive effects in other models of carcinogens, that includes chemical, radiation and viral carcinogenesis models. Jamun raw and value added products should be advertised to urban population for its health benefits and specically for promotion of Jamun growers in tribal areas of India.

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Chapter - 5

Health Benefits of Grapes

Ranajit Kumar Khalua

Introduction

The phytochemicals present in fruits and vegetables may play an important role in deceasing chronic disease risk. Grapes, none of the most popular and widely cultivated and consumed fruits in the world, are rich in phytochemicals. Epidemiological evidence has linked the consumption of grapes with reduced risk of chronic diseases, including certain types of cancer and cardiovascular disease. *In vitro* and *in vivo* studies have shown that grapes have strong antioxidant activity, inhibiting cancer cell proliferation and suppressing platelet aggregation, while also lowering cholesterol. Grapes contain a variety of phytochemicals, like phenolic acids, stilbenes, anthocyanins, and proanthocyanidins, all of which are strong antioxidants. The phytochemical composition of grapes, however, varies greatly among different varieties. While extensive research exists, a literature review of the health benefits of grapes and their phytochemicals has not been compiled to summarize this work. The aim of this paper is to critically review the most recent literature regarding the concentrations, biological activities, and mechanisms of grape phytochemicals.

Types

Table Grapes: These are grown for domestic consumption. The skin is usually thin and quite a few of these varieties are seedless.

Raisins and Currants: They are classified as dried-fruits, these dried grape varieties are also referred to as sultanas. The sultana was among the first known raisins and originally made from Turkish Sultana grapes.

Wine Grapes: They belong to the same species – Vitis Vinifera, but are grown primarily for wine production. Wine grapes in most parts of the world tend to be smaller, seeded and have thicker skins. These grapes are also harvested at a time when their juice is roughly 24% sugar by weight.

Nutritional and Chemical Composition of Grapes

Grapes are a natural source of beneficial plant compounds, including antioxidants and other polyphenols. A 3/4 cup serving of grapes contains just 90 calories, no fat, no cholesterol and virtually no sodium. Grapes are an excellent source of vitamin K.

One Cup (151 Grams) of Red or Green Grapes Contains the Following Nutrients

- **Calories:** 104
- **Carbs:** 27.3 grams
- **Protein:** 1.1 grams
- **Fat:** 0.2 grams
- **Fiber:** 1.4 grams
- **Vitamin C:** 27% of the Reference Daily Intake (RDI)
- **Vitamin K:** 28% of the RDI
- **Thiamine:** 7% of the RDI
- **Riboflavin:** 6% of the RDI
- **Vitamin B6:** 6% of the RDI
- **Potassium:** 8% of the RDI
- **Copper:** 10% of the RDI
- **Manganese:** 5% of the RDI

Source: Internet

Fig 1: Nutritional and Chemical Composition of Grapes

Present in fruits, vegetables, grains, wine, tea, chocolate, and other plant-based foods, phytochemicals are a wide variety of bioactive compounds that have been linked to reductions in the risk of major chronic diseases. It is estimated that over 8,000 phytochemicals have been identified. Due to the great structural diversity arising from various mechanisms of hydroxylation, glycosylation, methoxylation, and acylation, the phytochemical's number is constantly increasing. Generally, phytochemicals can be classified as alkaloids, carotenoids, nitrogen-containing compounds, organo sulfur compounds, and phenolics, the latter constituting the largest and most ubiquitous groups of phytochemicals. Grapes phytochemicals are synthesized by three secondary metabolic pathways, including phenylpropanoid, isoprenoid, and alkaloid biosynthetic routes. The main phytochemicals in grape arise from acetyl-CoA and shikimic acids. Phenolic acids, flavonoids, stilbenes, and proanthocyanidins are biosynthesized through the phenylpropanoid pathway.

Phenolics Compound in Grapes

Phenolics in grape are generally classified into two groups: flavonoids and nonflavonoids. The major flavonoids include flavan-3-ols, flavonols, and anthocyanins. Flavonoids, such as anthocyanins, are principally localized in the skins, while the flavan-3-ols are present in both the skins and seeds. The nonflavonoids encompass phenolic acids and stilbenes.

Health Benefits of Grapes

Grapes Contain Antioxidants and Other Polyphenols

Grapes of all colors contain a variety of antioxidants and other polyphenols. Antioxidants neutralize harmful free radicals to help prevent the process of oxidation that damages cells. Sounds pretty technical, but in fact, neutralizing free radicals happens naturally when we eat foods like grapes that promote antioxidant activity. When free radicals are left to their own devices, a condition called “oxidative stress” occurs. Oxidative stress is now associated with numerous health conditions and chronic illnesses.

Grapes Prevent Heart Disease

Human studies have shown that eating a variety of grapes may help support a healthy heart by promoting relaxation of blood vessels to help maintain healthy blood flow and function. Heart healthy grapes may also help promote healthy aging: studies looking into the health benefits derived from eating normal portions of grapes on a regular basis are underway at some of the nation’s most prestigious research institutions.

Grapes Help to Control High Blood Pressure

In a recent series of laboratory studies, animals were fed a salty diet and their blood pressures rose as a result. When grapes were added to their diet blood pressure levels dropped, heart function improved and inflammation was reduced throughout their bodies. These animals also showed fewer signs of heart damage compared to those who did not receive grapes in the diet.

A Boost for Colon Health

In a small human study of colon cancer patients, those consuming a grape-enriched diet (equal to adding 2 1/2 cups of grapes per day for two weeks) were able to inhibit certain genes that promote tumor growth in the colon. This benefit was observed in the healthy tissue of the subjects’ colons, not the cancerous, indicating a potential role for grapes in helping to maintain a healthy colon.

Grapes Also Help in Good Vision

In a recent laboratory study, grapes added to the diet prevented blindness in animals that were prone to developing retinal damage in old age, similar to age-related macular degeneration in humans. When compared to lutein, grapes offered significantly more protection.

Conclusion

Grapes contain a variety of antioxidants and other polyphenols. Antioxidants neutralize harmful free radicals to help prevent the process of oxidation that damages cells. It is concluded that grapes may help support a healthy heart by promoting relaxation of blood vessels to help maintain healthy blood flow and function. Grape-enriched diet (equal to adding 2 1/2 cups of grapes per day for two weeks) were able to inhibit certain genes that promote tumor growth in the colon.

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Chapter - 6

Mulberry Cultivation and Its Health Benefits

Shweta Parida

Introduction

Mulberry is a perennial and woody plant, belongs to the family *Moraceae* and genus *Morus* native of China. Mulberry plants showing fast growth and short proliferation period, a deciduous plant grows under various environmental conditions i.e., tropical, subtropical and temperate. Plants are preferred due to foliage yield since leaves constitute the only food of silkworm *Bombyxmori* L. For manufacturing silk and used for various activities due to their strong environment adaptability. About 12-16 species of genus *Morus*are found in sub-tropical, warm and temperate regions of Asia, Africa and North America.

Table 1: Classification of Mulberry

Kingdom:	**Plantae**
Subkingdom:	Tracheobionta
Supdivision:	Spermatophyta
Division:	Magnoliophyta
Class:	Magnoliopsida
Subclass:	Dilleniidae
Order:	Urticales
Family:	Moraceae
Genus:	*Morus*
Species:	*Nigra/alba/rubra*

(**Source:** USDA, NRCS. 2008. The PLANTS Database (http://plants.usda.gov, 28 June 2008).)

History

According to the Western history, mulberry sericulture came to India at about 140 BC from China. When British came to India, the flourishing silk trade exploited and developed silk centers in many parts of the country. The Company exported large quantities of silk produced in West Bengal to England. The Company's monopoly was abolished in 1836 and the entire trade turned over to private enterprise, due to improper organized system the silk industry in West Bengal declined. Prior to 19th century, sericulture was mostly confined to Northern and Eastern India and only during the later period, it had spread to the Southern peninsula which is now the major sericulture zone with a total production of 11550 M.T. amounting to about 88% of the raw silk production in India.

Silk is the undisputed queen of textiles over the centuries. Sericulture is cultivated in Karnataka, Bengal, TamilNadu, Andhra Pradesh, Jammu & Kashmir, Gujarat, Kerala, Maharastra, Uttar Pradesh, Rajasthan, Bihar, Orissa etc. Though India is the second largest silk producer in the World after China, it accounts for just 5% of the global silk market, since the bulk of Indian silk thread and silk cloth are consumed domestically. Germany is the largest consumer of Indian silk. Sericulture in India is an important agro-based cottage industry providing employment to millions in the villages and earning foreign every year. The export potential of Indian Sericulture Industry isevident from the fact that the annual export is Rs. 2879.56 crores during the year 2004-05. The Central Silk Board, Ministry of Textiles, Govt. of India has been acting as a facilitatorfor planning, development and monitoring of sericulture industry between the States and Central Govt. The subject of Research is the exclusivity of the Central Silk Board and its sub-ordinate Research and Training Institutes.

(http://www.seri.ap.gov.in/download/1_history%20of%20sericulture.pdf)

Geographical Distribution

Mulberry is a perennial and woody plant, belongs to the family *Moraceae* and genus *Morus* native of China. Mulberry plants showing fast growth and short proliferation period, a deciduous plant grows under various environmental conditions i.e., tropical, subtropical and temperate. It is widely cultivated in Europe, North America, Russia, Turkey and Pakistan.

There are about 68 species of the genus *Morus*, the majority of them occur in Asia, especially in China (24 species) and Japan (19). In India, there are many species of *Morus*, of which *Morusalba, M. indica*. M. *serrate* and *M. laevigata* grow wild in the Himalayas. Several varieties have been introduced belonging to *M. multicaulis*, *M. nigra*, *M. sinensis* and M. *phillippinensis*. Most of the Indian varieties of mulberry belong to *M. indica*. Mulberry cultivation occurs in almost all of India's states. The primary grower of the fruit is Karnataka, as this state provides approximately 160,000 hectares for its growth followed by Andhra Pradesh, Manipur, and West Bengal, respectively.

The primary mulberry variant grown in India is *Morusindica*. This type thrives in warm, balmy weather, making it best suited to the south of India. A second well-known mulberry type is *Morusalba,* also known as white mulberry. This north Indian fruit naturally thrives in Himachal Pradesh, Punjab, and Kashmir. White mulberries also grow in Maharashtra and Rajasthan. Another prominent mulberry variety is the Pakistan mulberry (*Morusserrata)*: this variant is relegated to Himachal Pradesh in the Himalayas, and in the sub-Himalayas at an elevation up to 3,300 meters. This unusual, caterpillar-like mulberry has made waves in the US, and it's sometimes found in California's trendiest farmers markets. A fourth type of common mulberry is the Himalayan mulberry (*Moruslaevigata)* about 18cm long, grows in Rajasthan, Maharashtra, West Bengal, Assam, and Manipur. These trees may live for at least a couple hundred years.Government of Odisha is trying to introducing Mulberry varieties like, V_1, S_1 & C_{1730} under irrigated condition and high yielding variety.

Fruiting Habit

Mulberry is a small deciduous tree growing to 10-13 m tall. The leaves are 10-20 cm long and 6-10 cm broad (up to 23 cm long on vigorous shoots), downy on the underside, the upper surface rough with very short, stiff hairs. The mulberry ovary is similar to that of other fleshy drupaceous fruits both morphologically and in growth pattern; therefore, the seed should be classified as a drupelet rather than an achene or nutlet. Each fruit contains a dozen or more small drupelets that have thin, membranous coats and endocarps (stones). In the development of the mulberry fruit, the calyx adheres to the ovary and becomes an accessory part of the drupelet. The multiple fruit is composed of many small, closely appressed drupelets. Cultivated fruits are about 2 cm long, but fruits from native-grown trees are usually less than 1 cm long and have a cylindrical shape.

Fruits ripen and drop from the trees and often dispersed by birds and animals. Fruiting season can be extended by applying plenty of water during the summer months. Varieties differ in size and color of ripe fruit and vary in taste from insipid to sweet. The fruits stain everything they touch.

Fig: a & b

Fig: c & d

Fig: (a) different stages of mulberry fruit, (b) mulberry at different maturity condition (c) and (d) mulberry fruit

In South India, fruits are observed in two seasons in a year once during October – November and the other during March – May. However, whenever mulberry is pruned or defoliate flowering takes place along with sprouting of auxiliary buds followed by fruit formation. This feature of mulberry is utilized in mulberry breeding programmes. The immature fruits are green in colour but changes to purplish to violet black. In certain species like *Morusalba*the fruits are white to pinkish and very sweet. In *Moruslavigata*the fruits are very long sometime measuring up to18cm.

Post Harvest Storage Condition

The mulberry fruits are often harvested by spreading a sheet on the ground and shaking the branches. The deep colored mulberry fruits are rich in phenolic compounds, including flavonoids, anthocyanins, and carotenoids. The quality of the mulberry deteriorated often easily as it contains about 72-84% of moisture and mostly free water. Mulberry deteriorated seriously after two days at 20℃, after six days at 10℃, and after 12 days at 0℃. During storage, the firmness and anthocyanin content of the mulberry decreased rapidly at 1.5℃. Through the sensory results of this study, it was adjudged that the marketability of mulberry could be maintained about 0.7 times at 1.5℃ and 1.3 times at -1.5℃ compared with the marketability at 0℃, respectively.

Nutritional Composition

Indian mulberry include three different varieties which differ in color as well as other nutritional parameters represented below. A mature mulberry may vary in its weight ranging from 2.14-4.07gm. Organic acids are found in cytoplasm of fruits with sugars that contribute the taste to fruit as well as a criterion for maturity. Mulberries are rich in malic acids followed by citric acids. Acids rapidly oxidised in body metabolism and constitute complex with heavy metal ions and their oxidation prevents their catalyzing effect. Organic acids also been reported to have a significant impact in the control of purity. A comparison between the sugar composition and various acid contents has been shown in table 2 and 3, respectively.

Table 2: Sugar composition of Mulberry

	Black Mulberry (*Morusnigra*)	**White Mulberry (*Morus alba*)**	**Red Mulberry (*Morusrubra*)**
TSS(°B)	16.7	20.4	15.9
Fructose (g/100gm)	5.634	6.269	5.407
Glucose(g/100gm)	7.748	6.864	6.068

Table 3: Organic acid contents (g/100g of fresh weight) of Mulberry

	Black Mulberry (*Morusnigra*)	**White Mulberry (*Morus alba*)**	**Red Mulberry (*Morusrubra*)**
Citric acid	1.084	0.393	0.762

Malic acid	1.323	3.095	4.467
Tartaric acid	0.123	0.223	0.336
Acetic acid	0.019	0.008	0.015
Succinic acid	0.342	0.168	0.132
Lactic acid	0.049	0.074	0.074
Fumaric acid	0.011	0.024	0.028

Phenolic compounds in fruits are responsible for taste, color formation, browning and positive effect on human health for its anti-oxidant activity. The variation of phenoic compounds in the fruits depends on many factors such as degree of maturity at harvest, genetic difference, and environmental conditions during fruit development. The phenolic content get increased during ripening stage due to the maximum accumulation of anthocyanin and flavonoids.Rutin, quercetin and morin are the most common flavonoids. Among the vitamins mulberries contain ample amount of Vitamin C as well as a no. of minerals, especially rich in potassium as compared to other minerals as represented in table 4, 5 and 6. They are rich in B-complex group of vitamins like vitamin B-6, niacin, riboflavin, folic acid and vitamin K. These vitamins are function as co-factors and help body in the metabolism of carbohydrates, protein, and fats.

Table 4: Antioxidant components (mg/100g of fresh weight) of Mulberry

	Black Mulberry (*Morusnigra*)	**White Mulberry (*Morus alba*)**	**Red Mulberry (*Morusrubra*)**
Ascorbic acid	11.3-22.4	21.8-24.4	16.1-19.4
Total flavonoids (mgQE/100gm)	190	276	219
Total phenolics (mg GAE/100gm)	181	1422	1035

Table 5: Phenolic contents (mg/g of fresh weight) of Mulberry

	Black Mulberry (*Morusnigra*)	**White Mulberry (*Morus alba*)**	**Red Mulberry (*Morusrubra*)**
Gallic acid	0.15	0.215	0.504
Catechin	0.075	0.037	0.086
Chlorogenic acid	3.106	0.199	0.569
Caffeic acid	0.131	0.133	0.116
Syringic acid	0.103	0.049	0.083
p-Coumaric acid	0.129	0.047	0.129
o-Coumaric acid	0.134	0.015	0.084
Ferulic acid	0.064	0.033	0.155
Phloridzin	0.031	0.011	0.031
Protocatechuic acid	0.017	0.015	0.012

Vanilic acid	0.036	0.008	0.024
Rutin	1.423	1.111	0.851
Quercetin	0.113	0.015	0.048

Table 6: Mineral contents (mg/g of fresh weight) of Mulberry

	Black Mulberry (*Morusnigra*)	**White Mulberry (*Morus alba*)**	**Red Mulberry (*Morusrubra*)**
Nitrogen	0.92	0.75	0.82
Phosphorus	232	242	226
Calcium	132	152	132
Magnesium	106	106	115
Sodium	59	60	61
Potassium	922	1668	834
Iron	4.2	4.2	4.5
Manganese	4.2	3.8	4
Cupper	0.4	0.5	0.4
Zinc	3.2	2.8	3.2

Pharmacological Profile

The importance of natural products is being revitalized to alleviate various health discrepancies. The link between health and diet is well documented and the consumers’ trend reflects conscience towards their dietary habits. Phytochemicals in diet could provide protection against several threats like free radical formation, degenerative disorders and lifestyle related diseases but still role of array of active ingredients should be unveiled. The rich benefits of *Morussp*. is its antioxidant potential, inhibition of LDL oxidation, neurodegenerative disorders and mode of action in boosting skin tone. It has a unique nutritional profile containing vitamins, phenolics, flavonoids and anthocyanins that enhances its significance as promising nature’s functional tonic. Chemistry of mulberry extracts or components especially flavonoids i.e. quercetin, rutin and isoquercitrin scavenge free radicals showing potential against oxidative stress. They provide cardiovascular protection and atherosclerosis.Mulberry fruit is a traditional Chinese edible fruit that is used effectively in folk medicines to treat fever, protect liver from damage, strengthen the joints, facilitate discharge of urine and lower blood pressure due to presence of bioactive substances steroids, flavonoids, amino acids, vitamins, tri-terpenes and other trace elements show valuable effects.

Mulberries have significantly high amounts of phenolic flavonoid phytochemicals called anthocyanins. Scientific studies have shown that consumption of berries have potential health effects against cancer, aging and neurological diseases, inflammation, diabetes, and bacterial infection as well as are the best source of health benefits as antioxidant and anti-inflammatory compounds. Anthocyanin has high inhibitory ability on lipid oxidation. Flavonoids have been recognized to possess anti-inflammatory, antioxidant, antiallergic, antithrombotic, hepatoprotective, antiviral and anti-carcinogenic activities in human beings. Mulberry juice can nourish the body fluid and strengthen eye sight. It contains plentiful nutritious elements such as minerals and vitamins which can cure chronic diseases of the digestive tract. The fruit itself is believed to be a remedy against constipation, premature aging, insomnia and tinnitus.

Resveratrol, in mulberry fruits protects against stroke risk by altering molecular mechanisms in the blood vessels; reducing their susceptibility to damage through reduced activity of angiotensin (a systemic hormone causing blood vessel constriction that would elevate blood pressure) but potentiating production of the vasodilator hormone, *nitric oxide*. Resveratrol (trans-3,41,5-trihydroxystilbene) and Oxyresveratrol (trans-2,31,4,51-tetrahydroxy stilbene) are hydroxystilbenes found in mulberry act as a potent neuroprotectant and has cardioprotective effect. Oxyresveratrol has an inhibitory effect on tyrosinase to limit melanin biosynthesis and used as cosmetic material and medical agent for hyper pigmentation disorders. Anthocyanin has high inhibitory ability on lipid oxidation and mulberry anthocyanin extract has anti-metastatic activity to inhibit migration of B16-F1 cells.

In addition, mulberries are an excellent source of vitamin-C (36.4 mg per 100, about 61% of RDI), which is also a powerful natural antioxidant. Consumption of foods rich in vitamin-C helps the body develop resistance against infectious agents, counter inflammation and scavenge harmful free radicals. Further, the berries also contain small amounts of vitamin A, and vitamin E, in addition to the above-mentioned antioxidants. Consumption of mulberry provides another group of health promoting flavonoid polyphenolic antioxidants such as *lutein, zea-xanthin, ß-carotene and α-carotene* in small but notably significant amounts. Altogether, these compounds help act as protect from harmful effects of oxygen-derived free radicals and reactive oxygen species (ROS) that play a role in aging and various disease processes. Zea-xanthin, an important dietary carotenoid selectively concentrates into the retinal macula lutea, where it thought to provide antioxidant functions and protects the retina from the harmful ultraviolet rays through light-filtering actions.

Mulberry fruit contains the cyanidin-3-O-β-D-glucopyranoside which prevents the neuronal cell damage. They also suggest that mulberry fruit extracts having neuroprotective properties and prevent the cerebral ischemic damage caused by oxygen glucose deprivation (OGD) in PC12 cells.

Mulberries are an excellent source of iron, which is a rare feature among berries, contains 1.85 mg/100 g of fruits (about 23% of RDI). Iron, being a component of hemoglobin inside the red blood cells, determines the oxygen-carrying capacity of the blood. They are also good source of minerals like potassium, manganese and magnesium. Potassium is an important component of cell and body fluids that helps controlling heart rate and blood pressure.

Conclusion

Mulberry plant is one of the important traditional herbs widely used in medicine from centuries ago. It is a rich source of flavonoids and other compounds that showed antimicrobial potential and free radical scavenging activity. Higher phenolic contents with antioxidant activity further increase their nutritive as well as phytomedicinal potentials. Mulberry is proved in protecting liver, improving eyesight, facilitating discharge of urine, lowering of blood pressure, anti-diabetic and weight controlling in human beings.Delicious, fleshy, succulent mulberries are less in calories (just 43 calories per 100 g). They compose of health promoting phyto-nutrient compounds like polyphenol pigment antioxidants, minerals, and vitamins that are essential for optimum health.

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Chapter - 7

Health Benefits of Star Fruits

Shweta Parida

Introduction

Star fruit, botanically known as *Averrhoa carambola*, grows in tropical and subtropical regions throughout the world. The Star fruit can be used raw as vegetable and ripe as fruit. The Star fruit is sweet tasting fruit that possesses high nutritional value. Star fruit, is a star shaped tropical fruit with sweet and sour flavor. The starfruit is about 2 to 6 inches in length. Major two distinct classes of Carambola, the Smaller with sour taste and the Larger with sweet taste. It is vegetatively propagated during the 1940's and 1950's and, later in 1965, and changed the name to 'Golden Star' and distributed for cultivation. The word carambola comes from the Sanskrit word Karmaranga meaning "food appetizer". Traditional medicines are plant derived medicines. According to WHO, more than 80% of developing country’s population depends on plant based medicines for their health care needs.

Starfruit Production

Starfruit is one of the tropical fruits and produced largely in South East Asian countries. Indonesia is one of the biggest producers with a production level of 81,653 tones in 2014 (Kementerian Pertanian, 2015). Starfruit is rich in vitamins, minerals, sugars, and fibers (Moreschi *et al.*, 2007). It is usually used to treat headaches, vomiting, coughing, and hangover, as an appetite stimulant, diuretic, ant diarrheal and febrifugal agent (Cabrini *et al.*, 2011). Star fruit is usually consumed fresh. The high moisture content, about 90% of fresh weight, make star fruit easy to lose its quality. One of effort to preserve the perishable fruit is processing it to become fruit juice and other products.

Geographical Distribution

It is believed to have originated in Ceylon and the Moluccas, but it has been cultivated in Southeast Asia and Malaysia for hundreds of years. It is commonly found in Sri Lanka, Southern China, Taiwan, Philippines, Queensland, Australia, Malaysia, Thailand, Israel, Florida, Brazil, Indonesia, in some of the South Pacific islands. It is commonly found in warmer parts of India, primarily in the southern states and along the west coast, extending from Kerala up to West Bengal.

Taxonomical Classification

Kingdom : Plantae
Subkingdom: Tracheobionta -Vascular plants
Superdivision :Spermatophyta
Division: Magnoliophyta–Flowering plants Class: Magnoliopsida – Dicotyledons Subclass : Rosidae
Order :Geraniales Family: Oxalidaceae–Wood-Sorrelfamily
Genus: AverrhoaAdans. – averrhoa
Species :*Averrhoa carambola*

History

It is believed that star fruit has originated in either Sri Lanka or the Moluccas (islands of Indonesia) and then relatively new to north and South America. In 1887, it was first introduced to Florida but is viewed as a decorative fruit and has not been planted on a wide scale. In the orient, it is usually called balimbing, belimbing, or belimbingmanis (sweet belimbing), to distinguish it from the bilimbi or belimbingasam. In 1935, Star fruit was introduced to the Caribbean islands, Central America, South America, and Hawaii and become very popular there. Today, star fruits are widely growing in Southern China, Taiwan, Philippines, Queensland, Australia, Malaysia, Thailand, Israel, Florida, Brazil, Indonesia, in some of the South Pacific Islands.

Cultivation

Climate: The carambola should be classed as tropical and subtropical environments because mature trees can tolerate freezing temperatures for short periods and sustain little damage at 27º F (-2.78º C). In an interior valley of Israel, all trees surrendered to the usual hot and dry winds. The carambola needs moisture for best performance and ideally rainfall for its growth. Older trees are more tolerant of frost, but growth stops at 55 to 60 degrees and prolonged exposure to temperatures.

Soil: Carambola are not too particular as to soil, it grows well on sand, heavy clay or limestone and in rich loam. It prefers a moderately acid soil (pH 5.5 - 6.5) and is sensitive to water logging.

Harvesting: The harvesting of carambola occurs during an eight-month period ranging from June through February depending on the blooming cycle. No tree produces fruit through this entire period, but trees will reach maturity at varying times during the period. In California, the peak of harvest is August through October and December through February. Star fruit is harvested by hand when the fruit develops a yellow color in the grooves of the star shape.

Storage: Starfruit generally stored at room temperature for maximum of two to five days. You can also store them in the refrigerator for up to 2 weeks and starfruit can also store in freezer for 10 to 12 months.

Nutritional Value of Star Fruit

The fruit is filled with fibre and only has 31 calories making it a good choice for those trying to lose weight. This fruit contains only contains 9.5g of carbohydrates per serving, 2.5g of dietary fibre, 3% of the recommended daily allowance for carbohydrates and 10% of the recommended daily allowance for dietary fibre and also full of antioxidants as well as flavonoids. Furthermore the star fruit is a good source of antioxidants and vitamin C which delays the natural ageing process. Once ingested, the presence of the fruit allows other nutrients to move freely in the body. Vitamin B complex which is needed for hair growth as well as keeping the hair shiny, healthy, strong and preventing hair loss is copiously abundant in star fruit. Table 1 gives a summary of the commonly known nutritional values of an average-size star fruit.

Table 1: Nutritional Value of Star Fruit

Nutrient	Amount
Energy	128 kj (31 kcal)

Carbohydrate	6.73g
Dietary fibre	2.8g
Protein	1.04g
Vitamin C	34.4g
Iron	0.08mg
Fat	0.33g
Sugars	3.98g
Zinc	0.12mg
Calcium	3mg
Vitamin B	60.017mg
Sodium	2g

Health Benefits of Star Fruit

Star fruit has many medicinal properties and is used widely all over the world for hangovers and sunburns. It also works very well to cure coughs, fever, ulcers and sore throats and is said to fight against diabetes. In India, the ripe fruit is administered to halt hemorrhages and to relieve bleeding hemorrhoids; and the dried fruit or the juice may be taken to counteract fevers. A conserve of the fruit is said to allay biliousness and diarrhea and to relieve a "hangover" from excessive indulgence in alcohol. A salve made of the fruit is employed to relieve eye. In Brazil, the carambola is recommended as a diuretic in kidney and bladder complaints, and is believed to have a beneficial effect in the treatment of eczema. In Chinese Materia Medica it is stated, "Its action is to quench thirst, to increase the salivary secretion, and hence to allay fever." A decoction of combined fruit and leaves is drunk to overcome vomiting. Leaves are bound on the temples to soothe headache. Crushed leaves and shoots are poulticed on the eruptionsof chicken-pox, also on ringworm. The flowers are given as a vermifuge. In Southeast Asia, the flowers are rubbed on the dermatitis caused by lacquer derived from Rhusverniciflua Stokes. Burkill says that a preparation of the inner bark, with sandalwood and Alyxia sp., is appliedon prickly heat. The roots, with sugar, are considered an antidote for poison. Hydrocyanicacid has been detected in the leaves, stems and roots. A decoction of the crushed seeds acts as a galactagogue and ernmenagogue and is mildlyintoxicating. The powdered seeds serve as a sedative in cases of asthma and colic.

Along with vitamins A, B and C, that help maintain the metabolism of the body regularly and sound, star fruit also contains thiamine, riboflavin, and niacin in small amounts. It is a good source of vitamin B9 (folic acid), which assists the body to decrease the rate of heart related diseases and stroke. It has a very small amount of all essential minerals most especially copper (14% of Recommended Dietary Allowance (RDA). It purifies the blood and makes the skin glow. Star fruit comprises of zinc which is known to decrease acne break outs and is very good for people of all ages because of its antimicrobial properties and referred as a “magic‟ fruit, indicated that lactating mothers can eat the fruit because it helps increase the production and flow of milk. A quick remedy for nausea and indigestion would be to eat half a piece of the fruit every three hours.

But, it is not recommended for people with renal/kidney problems due to the high concentration of oxalic acid. Due to its interference it can cause malabsorption and slow down metabolism of various natural minerals such as calcium, magnesium, etc., scientists consider the fruit an anti-nutrient compound. Carambola contains oxalic acid, which can be harmful to individuals suffering from kidney failure, kidney stones, or those under kidney dialysis treatment. Consumption by those with kidney failure can produce hiccups, vomiting, nausea, and mental confusion. Fatal outcomes have been documented in some patients.

Food Uses of Star Fruit

Ripe carambolas are used in puddings, tarts, stews and curries. In Malaya, they are often stewed with sugar and cloves, alone or combined with apples. The Chinese cook carambolas with fish. Thais boil the sliced green fruit with shrimp. Slightly underripe fruits are salted, pickled or made into jam or other preserves. In mainland China and in Taiwan, carambolas are sliced lengthwise and canned in syrup for export. In Queensland, the sweeter type is cooked green as a vegetable. Cross-sections may be covered with honey, allowed to stand overnight, and then cooked briefly and, put into sterilized jars. Some cooks add raisins to give the product more character. A relish may be made of chopped unripe fruits combined with horseradish, celery, vinegar, seasonings and spices. Indian experimenters boiled horizontal slices with 3/4 of their weight in sugar until very thick, with a Brix of 68º. They found that the skin became very tough, the flavor was not distinctive, and the jam was rated as only fair. Sour fruits, pricked to permit absorption of sugar and cooked in syrup, at first 33º Brix, later 72º, made an acceptable candied product though the skin was still tough. The ripe fruits are sometimes dried in Jamaica. Carambola juice is served as a cooling beverage. In Hawaii, the juice of sour fruits is mixed with gelatin, sugar, lemon juice and boiling water to make sherbet. Filipinos often use the juice as a seasoning. The juice is bottled in India, either with added citric acid (1% by weight) and 0.05 % potassium metabisulphite, or merely sterilizing the filled bottles for 1/2 hr in boiling water. To make jelly, it is necessary to use unripe "sweet" types or ripe sour types and to add commercial pectin or some other fruit rich in pectin such as green papaya, together with lemon or lime juice. The flowers are acid and are added to salads in Java; also, they are made into preserves in India. The leaves have been eaten as a substitute for sorrel.

Other Uses: The acid types of carambola have been used to clean and polish metal, especially brass, as they dissolve tarnish and rust. The juice will also bleach rust stains from white cloth. Unripe fruits are used in place of a conventional mordant in dyeing.

Conclusion

Averrhoa carambola also has the antioxidant properties among the various Indian tropical fruits i.e. it is capable of fighting against free radicals as well as the damage caused due to free radicals. Intake of fruits in the diet helps in lowering cholesterol, maintaining blood pressure and body weight. The fruit exhibits potential antioxidants as it is a significant source of phenolic antioxidants. From the time immemorial, the whole starfruit tree is used as a traditional medicine. The medicinal properties of Starfruit include anti-inflammatory, analgesic, hypotensive, anthelmintic, anti-oxidant, anti-ulcer, hypocholesterolemic, hypoglycaemic and hypolipidemic, antimicrobial, anti-tumor activities. It is effectively used in diabetes and help to reduce the risk of heart disease and stroke. In view of neutraceutical properties of Star fruits and to avoid their spoilage, the fruits can be processed into various products like jams, candy, pickles etc. This fruit if added in our diet can meet around 30% of our daily requirement of Vitamin C in just 100g.

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Chapter - 8

Amla and Its Nutritional Properties

Ankita Gautam

Introduction

Amla is a small deciduous tree found in Asian countries. It mainly grows about 8-18m height with light grey bark leaves are simple light green in colour. Amla is highly nutritious and is one of the richest sources of vita C amino acids and minerals. It contains several chemical constituents like tannins, alkaloids and phenols. Almost all parts contains medicinal properties, particularly fruits which has been used in Ayurveda as a powerful rasayana to cure many of the ailments. It has a beneficial role in treating some big diseases like cancer, diabetes, liver disorder, heart problem ulcer, anaemia, its also has its applications in using as antioxidants, immunomodulatory, antipyretic, analgesic and gastro protective.

Classification

- Kingdom- Plantae
- Subkingdom- Tracheobionta
- Super division- Spermatophyta

- Division- Angiosperma
- Class-Dicotyledonae
- Subclass- Rosidae
- Order- Geraniales
- Family- Euphorbiaceae
- Genus-Emblica
- Species- *officinalis*

Amla is one of the precious gift of the Mother Nature to the human. Fruits is rich source of Vit C, it also increases the red blood cell count and help to promote good health. It possesses the anti-inflammatory, antioxidant, Hepatoprotective and hypocholesterolaemia activities.

Vit C present in the amla is one of the main factors that can help to retrieve or refill the energy lost from the body. Many studies suggest that the fruit contains 28% of the total tannins distributed in the whole plant. As of the amla also contains the cooling nature it is common in use as a main ingredients in the treatment of burning sensation anywhere in the body.

Physical and chemical properties of Amla

Table 1: Physical and chemical properties of Amla

Content	Amount on percentage (%)
Protein	0.5
Fat	0.1
Mineral salts	0.7
Cellulose	3.4
Carbohydrate	14.1
Calcium	.05
Phosphate	0.02
Niacin/Nicotinic Acid	Traces/0.2mg/100g
Moisture	81.2
Iron	1.2mg

Its mineral and vitamin contents include calcium, phosphorous, iron, carotene, thiamine, riboflavin and niacin. The seeds contain a fixed oil, phosphatides and an essential oil. The fruits, barks and the leaves of this tree are rich sources in tannins. The roots contain ellagic acid and lupeol and bark contains leucodelphinidin.

Uses of Amla in Health Care and Nutrition Part

The plant is used in day to day life in many forms. One of the most popular use is as a decoction and infusions of leaves and seeds. However, it is also used as liquor, a fixed and essential oils, in confections, as a powder and also paste and pickles. It makes as astringent extract equal to catechu which is prepared mainly by roots by decoction and evaporation. The fresh juice is acidulous and fruit is mainly used in combinations.

Aperient

The green fruits are used to make pickles and is preserved as the aperient.

Antimicrobial

Many medicinal studies and researches were conducted on amla extracts which proves it to be antibacterial, antifungal and antiviral agents.

Antioxidant

Amla is potent to scavenger of free radicle. It contains high levels of free radicals, superoxide dismutase (SOD) this property of amla fruits makes it to be a super fruit today. With an ORAC (oxygen radical absorbance capacity) value of 1770 this fruit has twice the antioxidant power of acai and about 17 times that of pomegranate.

Boils and Spots

The pericarp of the fruit is often used in decoctions along with other ingredients and also applied externally on boils with cow ghee to promote suppuration.

Chelating Agent

Photoaging of the skin is a complex biologic process affecting various layer of the skin with major changes seen in the connective tissue within the dermis. Emblica was shown to reduce the UV-induced erythema and had excellent free radicle quenching ability chelating ability to iron and copper as well as MMP1 and MMP3 inhibitory activity.

Constipation

The fruit is occasionally pickled and preserved in sugar. When dry in condition it is said to be gently laxative. The fresh ripe fruit are used extensively in India asa laxative one or two fruits being sufficient for a dose.

Diabetes

The fruit is also use to treat diabetes and sometimes seeds are also used.

Diarrhoea

It is used medically for the treatment of the diarrhoea.

Fevers

Decoction extract of leaves is used to treat the fevers.

Similary in many more disesases and problems like Gonorrhoea, hair growth, nausea, nose bleed, headache, Perfumery, pruritis, respiratory problems, indigestions, inflammations, mouth ulcers, Scurvy, shin sores and wounds, skin whitening, sore eyes and tonics the amla plant parts are very useful.

Conclusion

Today it is popular that food can be used as a medicine. Ayurveda is 5000 year oldancient Indian health science have mentioned the medicinal benefits of the foods and its nutrition properties. Amla is the wonder fruit. Highly esteemed from the point of view of national and great medicinal properties. Amla is considered to be the richest source of the vit c which is readily assimilated by the human system.it is one of the oldest medicinal plant as potential effects for the various ailments. It is one of the natural source of medicine which is safe and have no side effects. It can be concluded that the Indian Gooseberry is having a numerous health benefits hence its intake in any form is very vital for the right functioning of the body. Many researches were going on today as many foods are being used as the nutraceuticals and biopharmaceutical.

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Chapter - 9

Medicenal and Health Benefits of Lemon

Sunita Popale

Introduction

Lemon is an important medicinal plant of the Rutaceae family that originated in tropical and subtropical Southeast Asia.[6] It has a distinctive berry with its internal parts divided into segments. It is cultivated mainly for alkaloids, which show anticancer activities and the antibacterial activities in crude extracts of different parts (viz., stem, root, leaves, and flower) of Lemon against clinically significant in bacterial strains.[9] Other members of the Citrus genus include citrons, oranges, limes, pomelos (pummelo, pommelo), grapefruit, and mandarins (tangerines). Most members of the genus Citrus arose as hybrids, and the types of hybridized of citrus, such as lemon (*Citrus limon*), may or may not be recognized as species according to different taxonomies.

Lemon peel contained crude fibres (15.18%), crude fat (4.98%), and protein (9.42%). Ash content of lemon peel is 6.26%. Lemon juice is about

5% acid, which gives lemons a sour taste and pH of 2 to 3.

A lemon tree can grow up to 10 meter (33 feet), but they are usually smaller. The branches form an open crown and are thorny. The leaves are green, elliptical-acuminate and shiny. Flowers have a strong fragrance and are white on the outside with a violet streaked interior. On a lemon tree, flowers and fruits can be found at the same time. Lemon and lime trees should not be grown in cooler winter areas, because they are more sensitive to winter cold than other citrus fruits.

Scientific Classification

- Kingdom – Plantae, Angiosperms, Eudicots, Rosids
- Order – Sapindales
- Family – Rutaceae
- Genus – Citrus
- Species – C. × limon
- Binomial name - Citrus × limon

Botanical Distribution

Lemon grows on small, thorny trees which reaches a height of 10 to 20 feet. The leaves of the lemon are dark green in colour and they are arranged alternately on the stem. The lemon has a white, fragrant flower with five petals. This particular flower comes from a lemon cultivar called 'Pink Lemonade'. The leaves of this cultivar are variegated and the fruit is striped. Lemons are oval citrus fruits with smooth porous skin. Some fruits have a pointed tip on the bottom of the fruit while other lemons are rounded at the base. Some kinds of lemons are quite larger than other lemon varieties and resemble elongated grapefruits. Lemon has many varieties few of which includes Bush lemon, Eureka, Lisbon, Ponderosa**,** Variegated Pink, Verna, Villafranca, Yen Ben and Yuzu. The colour range of lemon fruit is from greenish yellow to bright yellow. Lemons look very similar to limes, but lemons tend to be a little larger and are yellow when ripe, where limes are green.

Production

In 2010, the production of citrus fruit worldwide was estimated as 122.5 million tonnes with ~8.7 million hectares harvested; oranges were 50%–62% of the total area harvested and total production (Figure 1).

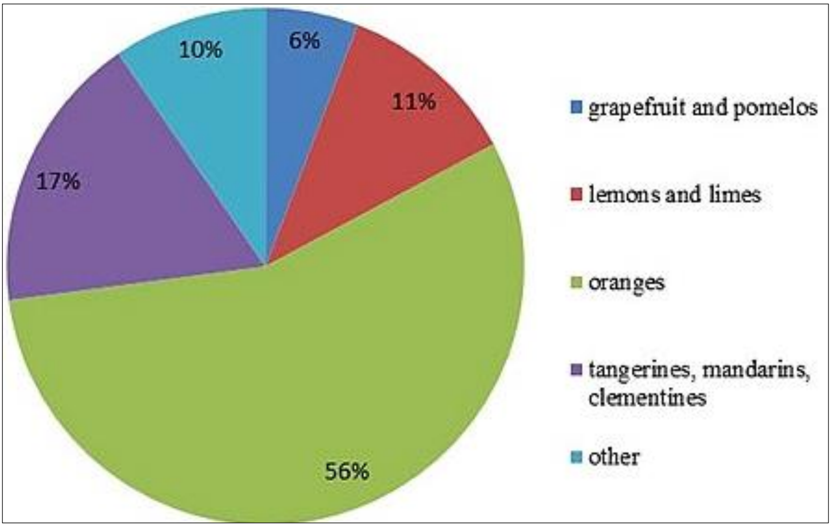

Fig 1: World production of citrus by fruit type in 2010.

Nutritional Value

Following is the nutritional value of 100 grams of raw lemon without peel.

- Energy – 121 kJ (29 kcal)
- Carbohydrates – 9.32 g
- Sugars - 2.50 g
- Dietary fibre – 2.8 g
- Fat – 0.30 g
- Protein – 1.10 g
- Thiamine (Vit. B1) – 0.040 mg (3%)
- Riboflavin (Vit. B2) – 0.020 mg (1%)
- Niacin (Vit. B3) – 0.100 mg (1%)
- Pantothenic acid (B5) – 0.190 mg (4%)
- Vitamin B6 – 0.080 mg (6%)
- Folate (Vit. B9) – 11 µg (3%)
- Vitamin C – 53.0 mg (88%)
- Calcium – 26 mg (3%)
- Iron – 0.60 mg (5%)
- Magnesium – 8 mg (2%)
- Phosphorus – 16 mg (2%)

- Potassium – 138 mg (3%)
- Zinc – 0.06 mg (1%)

Nutritional and Phytochemical Content of Citrus

Citrus contains no fat, sodium or cholesterol. The average energy value of citrus is very low which can be important for consumers concerned about obesity. Citrus contains large amounts of vitamin C and appreciable amounts of carotenoids (some capable of converting to vitamin A), folate, and fiber. The amount of selected nutrients are given in Table 3 along with the percentage of the recommended daily allowance (RDA) or adequate intake (AI) that is met when consuming 100 g of citrus fruit.

Phytoconstituent

The fruit juice mainly contains fruit acids, mainly citric acid (8%) and sugars. Lemon peel consists of two layers: The outer layer (pericarp, zest) contains an essential oil (6%), which is composed of citral (5%) plus traces of citronellal and limonene (90%), α-terpineol, geranyl acetate and linalyl. The inner layer (mesocarp), in the other word, contains no essential oil but a variety of coumarin derivatives and bitter flavone glycosides. It also contains a very little potash, sugar and gum. An imitation lemon juice has been prepared by dissolving tartaric acid into water, then adding sulphuric acid and flavouring with oil of Lemon. Oil of Lemon is dextrogyre. This contains 7 to 8% of citral, an aldehyde yielding geraniol upon reduction, a small amount of citronellal and pinene.

Pharmacological Profile

- **Prevent Kidney Stones:** Citrate levels in the urine raises by drinking one half-cup of lemon juice every day. In studies lemon juice shown that this could protect against calcium stones in the kidney.
- **Soothe a Sore Throat:** Honey mixing with lemon juice can help alleviate and discomfort to treat nasty sore throat.
- **Support Weight Loss:** Ancient time the old notion that the Master Cleanse was the only way lose weight with the help of lemons. New studies have shown the ways lemon juice supports weight loss. Lemon juice contains pectin, a soluble fibre which shown weight-loss.
- **Start Your Day Right:** Leave caffeinated drinks behind, and stimulation of digestive track by the using fresh lemon juice and hot water and add vitamin C.

- **Stop An Itch:** When it comes to insect bites or poison ivy, lemon juice rubbing on the area can soothe the skin. Lemon juice show anti-inflammatory and anaesthetic effects.
- **Anticancer Properties:** Studies have supported the citrus liminoids show anticancer activity, compounds that protect cells from damage which is the formation of cancer cells.
- **Potassium Power:** Lemons contain 80 milligrams of vitamin C mineral. Vitamin C with Bananas that helps your body stay strong and nimble.
- **Bring Down a Fever:** Drinking a lemon juice mixture can help bring your fever down faster. When body temperature goes up.
- **Balance pH:** While lemons may seem quite acidic, lemon is good source of an alkaline food that can help balance pH of body.

Health Benefits of Lime

The health benefits of lime include weight loss, skin care, good digestion, relief from constipation, eye care, and treatment of scurvy, piles, peptic ulcer, respiratory disorders, gout, gums, urinary disorders, etc.

The first fruit that comes to our minds when it comes to medicinal uses is perhaps the good old lime. This sour citrus fruit can do what many specialist medicines cannot. Lime, bearing the scientific name Citrus Aurantifolia, is being used for ages for treatment of various ailments.

The Benefits and Medicinal Uses of Lime

Scurvy

Lime is so famous as a cure for scurvy, the disease which is caused due to deficiency of vitamin-C and characterized by frequent infections with cough and cold; cracked lips and lip corners; ulcers in tongue and mouth; spongy, swollen and bleeding gums etc. that now a days even a child can tell you that. Since its cause is deficiency of vitamin-C, its remedy is none other than vitamin-C, and lime is blessed with this vitamin. In olden days, soldiers and sailors were given lime to keep safe from scurvy, which was a dreaded disease then. Even now, it is distributed among the workers working in polluting environments like those working in furnaces, painting shops, heat treatments, cement factories, mines etc. to protect them from scurvy.

Skin Care

Lime juice and its oil are very beneficial for skin when consumed orally or applied externally. It rejuvenates the skin, keeps it shining, protects it from infections and reduces body odor due to presence of a large amount of vitamin-C and Flavonoids, both of which are class-1 anti oxidants, anti biotic and disinfectants. When applied externally on skin, its acids scrub out the dead cells, cures dandruff, rashes, bruises etc. and gives you a refreshing bath if its juice or oil is mixed into your bathing water.

Digestion

Lime has an irresistible scent which waters the mouth and thus aid primary digestion (the digestive saliva floods your mouth even before you taste it). Then the acids in it do the rest. While they break down of the macro molecules of the food, the Flavonoids, the compounds found in the fragrant oils extracted from lime, stimulate the digestive system and increase secretion of digestive juices, bile and acids and also stimulate the peristaltic motion. This is the reason behind having lemon pickle with lunch and dinner is an age old practice in India and some of its neighbouring countries.

Constipation

Primarily, the ample of acids present in lime helps clear the excretory system by washing and cleaning off the tracts, just like some acids are used to clean floor and toilets. Then the roughage in it is also helpful in easing constipation. But it is mainly due to high acids. An overdose of lime juice with salt also acts as an excellent purgative without any side effects, thereby giving relief in constipation.

Peptic Ulcer

In addition to vitamin-C, lime contains special compounds called Flavonoids (Limonoids such as Limonin Glucoside) which have anti oxidant, anti carcinogenic, anti biotic and detoxifying properties which help healing of peptic and oral ulcers.

Respiratory Disorders

The oil, containing Flavonoids and certain oils, extracted from lime is extensively used in anti congestive medicines such as balms, vaporizers, inhalers etc. due to presence of Kaempferol. Just scratching the peel of a lime and inhaling it gives immediate relief in congestion and nausea.

Eye Care

Vitamin-C again! Its anti oxidant properties protect eyes from aging and macular degeneration.

Flavonoids help protect them from infections.

Gout

There are two main causes of Gout. While the first reason is accumulation of free radicals in the body; the second is accumulation of toxins, primarily uric acid. Now, limes can help you with both of these. It is a reservoir of anti oxidants & detoxifiers (vitamin-C & Flavonoids) which free radicals as well as detoxify the body.

Gums

The root causes of gum problems are deficiency of vitamin-C (Scurvy, which gives bleeding and spongy gums) and microbial growth. Sometimes, the ulcers and wounds from bones, hard objects etc. are also the causes. In all of these, limes can help you. Its vitamin-C cures scurvy, Flavonoids inhibit microbial growth and potassium and Flavonoids help heal ulcers and wounds.

Piles

Since lime helps to heal up ulcers and wounds in the digestive system and excretory system and gives relief from constipation too, it eradicates all the root causes of piles.

Weight Loss

A glass of warm water with a full-lime juice in it is an excellent weight reducer as well as a brilliant refresher and anti oxidant drink. The citric acid present in lime is an excellent fat burner. Just have two glasses a day and see the remarkable result within a week.

Conclusion

Lemons are a very versatile and healthful fruit. It’s having nutritional and medicinal value. It is good appetizer and digestive, helps to cure diseases. According to literature does not reveal any adverse effect of lemon so it is used as traditional medicine in all over world.

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Chapter - 10

Banana: Its Facts and Potential Health Benefits

Binod Kumar Bharti

Introduction

Banana is an edible fruit and belonging to the genus Musa and the family Musaceae. Banana is also eaten as cooked vegetable so it is called plantains. All the edible banana fruits are seedless and belonging two main species such as *Musa acuminata Colla* and *Musa balbisiana Colla*. The hybrid from these two species of banana is *Musa x paradisiaca* L. Banana fruits are native of Indomalaya and Australia, Papua New Guinea. Banana has now spread 135 countries around the world. About 28 per cent of the total world's banana production comes from India and China. Banana is an important fruit crop of many tropical as well as subtropical regions of India. Main banana growing states are Tamil Nadu, Maharashtra, Gujarat, Karnataka and Andhra Pradesh. Banana is rich in carbohydrates, dietary fibres, certain vitamins and minerals, it is also rich in many health-promoting bioactive phytochemicals. Potassium is a powerful mineral in banana fruits, which aids the cardiovascular system for maintaining a low and regular blood flow. Each banana contains 350mg of potassium, so including one banana per day in diet can help reduce the chances of developing blood pressure problems. The banana fruit has been enjoyed by everyone including animals and across the planet. Banana is tasty, healthy and cheap to purchase. Bananas are good for health because it is a full of nutrients. Generally, the taste and nutritional value of bananas fruits change as they ripen. Fresh ripened bananas tend to be less sweet than well ripened bananas because the starch has not fully broken down into simple sugars. It contains three natural sugars such as sucrose, fructose and glucose and it giving a fat and cholesterol-free source of energy. Bananas fruits are ideal especially for children and athletes, for breakfast, as a mid-day snack and in sports. Banana is not only tasty, snack size and great energy boosters, they carry a variety of mental and physical health benefits too. Another health benefit of banana fruits that secures bananas a super food title is their mental health benefits. Tryptophan is a protein, found in bananas which the body uses to convert into serotonin. This helps promote relaxation and better moods. Bananas also rate low on the Glycaemic Index (GI), which measures the impact of food on our blood sugars.

What are Bananas?

Banana is derived from the Arabic word “banan”, meaning finger, bananas grow in bunches called “hands”. It grow in clusters containing 50 – 150 bananas on every plant. Bananas fruits are packed full healthy nutrients and vitamins that benefit our bodies. It contains four major nutrients are Vitamin B_6, Vitamin C, Manganese and Potassium. A medium sized banana will contain roughly 95Kcal and contain little fat, sodium or cholesterol. A medium sized banana should contains around 3g of fibre and this ranks are high on the food fibre content index. The fibre found in bananas is largely soluble and have shown lowers risk of heart disease. Fibre is brilliant for the digestive tract also. It helps regulate the speed at which your body converts carbohydrates into simple sugars.

Chemical Composition of Banana Fruits

Bananas fruits contains various nutrients like carbohydrate 24.0%, protein 1.30%, fat 0.4%, ash 0.8% and water 73.5% (FAO).Bananas contain three natural sugars such as sucrose, glucose and fructose.

Table 1: Chemical Composition of banana fruit (per 100 g)

Constituent	Amount daily Intake
Energy	89 Kcal
Water	74.91g
Carbohydrates	22.84g

Sugar	12.23g
Dietary fibre	2.6g
Vitamin	
Pantothenic acid (B5)	0.334mg
Pyridoxine (B6)	0.4mg
Choline	9.8mg
Vitamin C	8.7 mg
Minerals	
Magnesium	27mg
Phosphorus	22mg
Potassium	358mg
Sodium	1 mg
Zinc	0.15mg

(**Sources:** USDA databases)

Nutritionally Importance of Banana Fruits

i. It is a rich source of vitamin B_6.
ii. It is a good source of vitamin C.
iii. It contains dietary fibre.
iv. It contains manganese.
v. It contains potassium.
vi. It is also fat free and cholesterol free.
vii. It contains phenolic compound.
viii. It also contains an antioxidant Compounds.

Banana is a Superfood

Superfoods are foods that have a very high nutritional density. This means that they provide a substantial amount of nutrients and very few calories. They contain a high volume of minerals, vitamins and antioxidants. Antioxidants are natural molecules that occur in certain foods. They help neutralize free radicals in our bodies. Free radicals are natural by products of energy production. Antioxidant molecules decrease the effects of free radicals that have close links with the following health problems: cancer, heart disease, stroke, arthritis, respiratory diseases and immune deficiency. Banana fruits have high levels of fiber and potassium, plus significant amounts of vitamins B_6 and C, so bananas are high up on the superfood list. Nutritious and delicious, they help lower blood pressure and can protect against hypertension, among other things.

Ripening of Banana Fruit

Bananas are a staple starch fruits for many tropical populations. Depending upon cultivar and ripeness, the flesh can vary in taste from starchy to sweetand the texture from firm to mushy. Both the skin and inner part can be eaten raw as well as cooked. The primary component of the aroma of fresh bananas have isoamyl acetatealong with some other compounds like butyl acetate and isobutyl acetate, both are significant contributor to banana fruits flavour.During the ripening process of bananas, it produces ethylene gas, which acts as a plant hormone and indirectly affects the flavour. Ethylene stimulates the formation of amylase enzyme that breaks down starch into sugar and influencing the taste of bananas. The greener, less ripe bananas contain higher levels of starch and have a starchier taste. On the other hand, yellow colour bananas taste sweeter due to higher sugar concentrations. The ethylene signals are produces pectinase enzyme which breaks down the pectin between the cells of the banana andalso causing the banana to soften when it ripens.

Health Benefits of Banana Fruits

- **Anaemia**

Banana fruits contains iron. It can stimulate the production of haemoglobin in the blood and so it helps in cases of anaemia.

- **Depression**

Banana fruit contain tryptophan. Tryptophan protein that the body converts into serotonin, known to make relax, improve mood and makes feel happier. People are suffering from depression feel better after eating banana.

- **Healthy Heart and Blood Pressure**

Banana is a tropical fruit and it is extremely high in potassium yet low in salt, making it perfect to beat blood pressure. Potassium in bananas is good for our heart health and blood pressure. A medium-sized banana will provide around 320-400 mg of potassium, which meets about 10% of your daily potassium needs. Potassium helps our body maintain a healthy heart and blood pressure. In addition, bananas are low in sodium. The low sodium and high potassium combination also help to control high blood pressure.

- **Constipation**

In the diet, high in fiber, including bananas can help restore normal bowel action, helping to overcome the problem without resorting to laxatives.

- **Temperature Control of Body**

Bananas is called a cooling fruit that can lower both the physical and emotional temperature of expectant mothers.

- **Smoking and Tobacco Use**

Bananas can also help people trying to give up smoking. Banana contains vitamins B_6, B_{12}as well as the potassium and magnesium found in them, it helps the body recover from the effects of nicotine withdrawal. Vitamin B_6 from bananas is easily absorbed by our body and a medium-sized banana can provide about a quarter of our daily vitamin B_6 needs. Vitamin B_6 is also good for pregnant women as it helps meet their baby's development needs.

- **Morning Sickness**

Snacking on bananas between meals, it helps to keep blood sugar levels up and avoid morning sickness.

- **Calm the Nerves**

Bananas are rich in B vitamins that can help calm the nervous system. Vitamin B_6 is also good for pregnant women as it helps meet their baby's development needs. Vitamin B_6 helps our body especially in produce red blood cells, metabolise carbohydrates and fats, turning them into energy, metabolise amino acids, remove unwanted chemicals from your liver and kidneys, and maintain a healthy nervous system.

- **Digestion and Gastrointestinal Issues**

Medium banana provides about 10-12% of your daily fibre needs. Soluble and insoluble fibres play an important role in our health. Soluble fibre helps our body control our blood sugar level and get rid of fatty substances such as cholesterol. Insoluble fibre adds weight and softness to stools and making it easier for regular bowel movements. This helps to keep gut healthy and safe from harmful bacteria. Bananas, especially newly-ripened ones, contain starch that does not digest in our small intestine and is able to pass into the large intestine. Such bananas help to manage our weight better as stay full for longer. Bananas can help beat gastrointestinal issues such as: constipation, stomach ulcers, and heartburn.

- **Ulcers**

Banana is used in dietary food against intestinal disorders because of its soft texture and smoothness. Banana is the only raw fruit that can be eaten without distress in over-chronicler diseases. It neutralizes over acidity also reduces irritation by coating the lining of the stomach.

- **Seasonal Affective Disorder (SAD)**

Bananas can help seasonal affective disorder sufferers because they contain the tryptophan. Because, tryptophan is a natural mood enhancer.

- **Heartburn**

Bananas have a natural antacid effect in the body, so if people are suffering from heartburn, then try to eating a banana for soothing relief.

- **Stress**

Potassium helps normalize the heartbeat and it sends oxygen to the brain and also regulates body's water balance. When we are stressed, our metabolic rate rises, thereby reducing our potassium levels. These level can re-balanced with the help of a high-potassium banana snack.

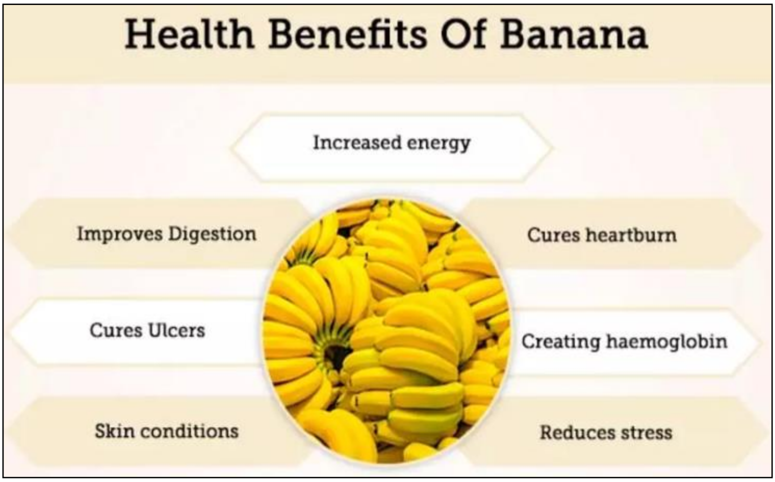
- **Hangovers**

For curing a hangover is to make a banana milkshake, sweetened with honey. The banana calms the stomach and with the help of the honey, builds up depleted blood sugar levels and milk soothes.

- **Mosquito Bites-Reduce Swelling and Irritation**

Before using for the insect bite cream, try rubbing the affected area with the inside of a banana skin. It reducing swelling and irritation of the affected area.

Schematic Representation of Heath Benefits of Banana Fruits



(**Source:** Internet Wikipedia, 2019)

Conclusion

The banana fruits are the most commonly eaten fruit in the world. Bananas eating are suitable for everyone, including people with diabetes, to eat them. Bananas are good for health because it is a full of nutrients. It is not only tasty, snack size and great energy boosters, they carry a variety of mental and physical health benefits too. The above discussion brings out the importance of consuming banana fruits for obtaining various health benefits. It is not only the banana fruit pulp, but also the peel of this fruit is known to contain many important phytochemicals and offers many health benefits. The taste and nutritional value of bananas change after ripen. Fresh ripened bananas tend to be less sweet than well ripened bananas because the starch has not fully broken down into simple sugars.

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Chapter - 11

Health Benefits of Orange

Balajee Mete

Introduction

Plants have anchored to the mother earth long before man set his feet on earth. God has endowed mankind with materials for survival much before his arrival on earth. The world health organization (WHO) estimates that about 80% of the population still depends upon herbal medicines for the treatment of various diseases due to easy availability, economic reasons and fewer side effects. Herbal remedies have formed the basis of traditional systems of medicine for ages and have formed the foundation of modern pharmacology. Herbal medicines have long history of popularity, better patient tolerance as well as acceptance. Availability of medicinal plants is not a problem especially in developing countries like India, which is having rich agro climatic, cultural and ethnic biodiversity. Orange, the tasty, juicy fruit, belonging to the family Rutaceae is botanically known as citrus sinensis. Citrus sinensis is one of the most important and widely grown fruit crops, with total global production reported to be around 120 million tons. Orange trees are widely cultivated in tropical and subtropical climates for its tasty juice and medicinal value. In worldwide trades citrus fruits generate about 105 billion dollars per year all over the world. Orange fruit is cultivated in more than 130 countries including India, UK, France, Germany, Holland, Brazil, China, USA and Spain. Oranges are generally available from winter through summer with seasonal variations depending on the variety. The centre of origin of most citrus cultivars is perhaps unknown, but the ancient relatives of citrus are native to China, the Southeast Asia, the Malay Archipelago, New Caledonia and Australia. The genetic origin of sweet orange is not clear, although it is believed to be derived from the interspecific hybridization of some primitive citrus species. Hence, its many cultivars are grouped into four major categories or varieties according to origin (Mediterranean and Spanish oranges) and taste. The navel oranges named because of its shape, (segmented skin looks like a human navel) originated as a single mutation in a Brazilian monastery in 1820. Every single navel orange originates from it because they do not produce seeds and propagation is through graft cuttings. The popularity of these oranges continued to grow resulting to its success across the world. The Valencia orange was named by William Wolfkill, an agronomist after the Spanish city of Valencia known for its orange production. Blood oranges named from their crimson flesh range from sweet to tart depending on the fruit. There are three types of blood oranges: moro, tarocco and sanguinello, each differing in taste, size and origin. Blood oranges are used to make sorbets, marmalade and beverages. The Seville orange is a type of bitter orange, primarily grown around the Mediterranean. Many countries have claimed origin to the Seville orange. There are reports of this fruit in ancient Fuji, Guam and Sicily. However, it is not known it was first cultivated in Seville, Spain. Spaniards brought this orange over to St. Augustine, Florida, where settlers cultivated it and sent it to England. It is used to make marmalade, liquor and wine. The Chinotto bitter orange is mainly cultivated in Italy as one of the main ingredients in many Italian wines and soft drinks. They possess unusual leaves compared to others, because they are from myrtle-leafed orange trees. Peel quality is of particular economic importance in orange production because factors such as shape, color, aroma, texture, and ease of peeling influence consumer demand. For example, the Clementine Mandarin has replaced navel varieties largely due to convenient size and ease of peeling.

The sub-genus *Citrus* (Swingle), family Rutaceae and subfamily *Aurantioideae* is of three types: *Citrus*, *Fortunella (Kumquat)* and *Poncirus Trifoliata*. There are three genera and eighteen defined species, but other natural mutations exist resulting to numerous hybrids which are widely spread throughout the world. Citrus is widely grown in Nigeria and many other tropical and subtropical regions. In terms of volume in production, citrus ranks after banana as the world second fruit crop with more than 108 million tons (FAO Statistics 2006). Sweet orange (*Citrus sinensis* L. Osbeck) commonly called orange is a member of this family and a major source of vitamins, especially vitamin C, sufficient amount of folacin, calcium, potassium, thiamine, niacin and magnesium. Economically, oranges are important fruit crops, with an estimated 60 million metric tonnes produced worldwide as at 2005 for a total value of 9 billion dollars. Of this total, half came from Brazil and the United States of America. The global citrus acreage according to FAO statistics in 2009 was nine million hectares with production put at 122.3 million tons, ranking sweet oranges first among all the fruit crops.

Oranges probably originated from south East Asia, and were cultivated in China by 2500 BC, where it was referred to as ‘’Chinese’’ apple. Today, it is grown almost all over the world as a source of food for humans because of its high nutritional values, source of vitamins and other uses. Propagation through seed is associated with problems like poor pollen production, self-incompatibility and muscular embryo. Therefore budding onto appropriate rootstocks is the common means of assuring the reproduction of cultures of known quality. Arsingrin, posited the use of tissue culture to produce good quality plantlets, but are highly susceptible to root diseases, and this limits production. This paper reviews the importance of oranges to human health, the impact of diseases on its production and control measures that should be adopted to realise its maximum benefits in the promotion of human health.

Nutritional Value of Sweet Orange

Composition	Amount
Energy	197 kJ (47 kcal)
Sugars	9.35 g
Dietary fibre	2.4 g
Fat	0.12 g
Protein	0.94 g
Water	86.75 g
Vitamin A equiv.	11 μg (1%)
Thiamine (vit. B1)	0.087 mg (8%)
Riboflavin (vit. B2)	0.04 mg (3%)
Niacin (vit. B3)	0.282 mg (2%)

Pantothenic acid (B5)	0.25 mg (5%)
Vitamin B6	0.06 mg (5%)
Folate (vit. B9)	30 μg (8%)
Choline	8.4 mg (2%)
Vitamin C	53.2 mg (64%)
Vitamin E	0.18 mg (1%)
Calcium	40 mg (4%)
Iron	0.1 mg (1%)
Magnesium	10 mg (3%)
Manganese	0.025 mg (1%)
Phosphorus	14 mg (2%)
Potassium	181 mg (4%)
Zinc	0.07 mg (1%)

Source: USDA Nutrient Database (2014)

Nutritional Value

A single orange provides 12.5% of the daily need for fiber, which has been shown to reduce high cholesterol levels thereby helping to prevent atherosclerosis. Fibers also help in keeping blood sugar levels under control, which may explain why oranges can be a very healthy snack for people with diabetes. In addition, the natural fruit sugar present in oranges, viz; fructose can help to prevent blood sugar levels from rising too high after eating. The fiber in oranges can grab cancer-causing chemicals and keep them away from cells of the colon, providing yet another line of protection from colon cancer. Furthermore, the oranges may be helpful in reducing the constipation or diarrhea in those suffering from irritable bowel syndrome.

Health Benefits of Orange Fruit

1. Wholesome Health

Oranges also contain very good amount of vitamin A, and other flavonoid antioxidants such as alpha and beta carotenes, beta-cryptoxanthin, zeaxanthin and lutein, compounds that have antioxidant properties. Vitamin A is rnecessary for maintaining healthy mucus membranes, skin and essential for vision. It is also a very good source of B-complex vitamins such as thiamin, pyridoxine and folates. These vitamins are essential in the sense that body requires them from external sources to replenish. Orange fruit also contains a very good amount of minerals like potassium and calcium. Potassium in an important component of cell and body fluids helps control heart rate and blood pressure. Vitamin A also required for maintaining healthy mucus membranes and skin and is also essential for vision.

Consumption of natural fruits rich in flavonoids helps body to protect from lung and oral cervical cancers. Orange fruit also contains a very good amount of minerals like potassium and calcium. Potassium is an important component of cell and body fluids and helps to control heart rate and blood pressure. The alkaline properties in the orange stimulate the digestive juices, thus, reliving constipation. Regular intake of orange juice reduces the chances in the formation calcium oxalate which causes kidney stones. Polyphenols present in oranges prevents viral infections. Oranges protect the skin from damage caused by free radicals, thereby helping you look young and keeps the skin fresh and glowing.

2. Anti-Oxidant Property

Oranges form a rich source of vitamin C, flavonoids, phenolic compounds and pectins. The main flavonoids found in citrus species are hesperidine, narirutin, naringin and eriocitrin, just one orange provides 116% of the daily requirement for vitamin C. Vitamin C is the primary water-soluble antioxidant, which prevents free radical generation in the body and damage to the tissues in the aqueous environment both inside and outside cells. Drinking of orange juice without salt and sugar is associated with reduced severity of inflammatory conditions, like asthma, osteoarthritis, and rheumatoid arthritis. Vitamin C is also necessary for the proper functioning of immune system. Vitamin C is good for preventing cold, cough and recurrent ear infections.

3. Protection against Cardiovascular Diseases

According to World Health Organization's recent report, citrus fruits offer protection against cardiovascular diseases by reducing levels of homocysteine. Orange fruit contains vitamin C, carotenoids and flavonoids, which are cardio protective. Cholesterol lowering effect of orange is produced by Limonene. Polymethoxylated flavones (PMFs) are present in citrus fruit peel, which can lower cholesterol more effectively than some prescription drugs, without showing any side effect. Although, a variety of citrus fruits contain PMFs, the most common PMFs are tangeretin and nobiletin, which are found in the peels of oranges. PMFs work like statin drugs that inhibit the synthesis of cholesterol and triglycerides inside the liver. However, grating a tablespoon or so of the peel of orange each day and using it to flavor tea, salads, yogurt, soups, snacks or rice may be a practical way of achieving some cholesterol-lowering benefits.

4. Anti-Carcinogenic Property

Limonene, one of the main constituents of orange, reduces the risk of mouth, skin, lung, breast, and stomach and colon cancer. Another constituent of orange is hesperidin, and its flavone analogue, diosmin, has also exhibited anti-carcinogenic activities in various *in vivo* studies. Anti-carcinogenic activity mainly depends on antioxidant properties of the molecules, as well as their ability to modulate the activity of detoxifying hepatic enzymes. The polymethoxylated flavones have shown strong anti- proliferative action against cancer cells and antigen activated T-lymphocytes. β-cryptoxanthin (an orange-red carotenoid) is present in highest amounts in oranges. It may significantly lower one's risk of developing lung cancer.

5. Reduced Risk of Kidney Stones

A study published in the British Journal of Nutrition found that when women drank 1/2 liter of orange juice daily, their urinary pH value and citric acid excretion increased thereby diminishing the risk of forming calcium oxalate stones significantly.

6. Anti-Obesity

Sweet oranges contain low calories and no saturated fats or cholesterol, but is rich in dietary fibre, pectin which is very effective in persons with obesity. Pectin as bulk laxative protects the mucous membrane from exposure to toxic substances, as well as by binding to cancer causing chemicals in the colon. Pectin has also been shown to reduce blood cholesterol levels by decreasing its re-absorption in the colon by binding to bile acids in the colon. Orange peels contain the alkaloid synephrine, which reduces the production of cholesterol in the liver. The antioxidant elements in oranges combat oxidative stress that oxidizes the LDL (low-density lipoprotein) in the blood.

7. Anti-Ulcer Property

Intake of orange juice on regular basis reduced the infection incidence with Helicobacter pylori (H. pylori) thus preventing development of ulcer.

8. Anti-Anxiety Effect

Aroma-therapists use orange oil as a tranquilizer. Researchers have found evidence that sweet orange oil is an anxiolytic agent.

9. Anti-Typhoid Activity

Typhoid fever (TF) caused by Salmonella typhi, is a major public health problem, particularly in developing countries. Constituents of orange fruit responsible for anti-typhoid activity include flavonoids like citacridone, citbrasine and saponins.

10. Anti-Bacterial Activity

Oranges are eaten to allay fever. The roasted pulp is prepared as a poultice for skin diseases. The fresh peel is rubbed on acne. A decoction of the dried leaves and flowers is taken in Italy and France as an antispasmodic, cardio-protective and anti-emetic.

11. Anti-Inflamation

Citrus flavonoids contain compounds with anti-inflammatory activity due to the presence of regulatory enzymes (protein kinase C, phosphodiesterase, phospholipase, lipoxygenase, and cyclooxygenase) that control the formation of the biological mediators, responsible for the activation of endothelial cells and specialized cells involved in inflammation. Flavonoid inhibition of the immune and inflammation responses can be associated with their inhibition of these enzymes Indeed, citrus flavonoids are able to inhibit the kinases and phosphodiesterases essential for cellular signal transduction and activation.

Conclusion

It is concluted that the Oranges form a rich source of vitamin C, flavonoids, phenolic compounds and pectins. orange has anti-inflammatory activity due to the presence of regulatory enzymes (protein kinase C, phosphodiesterase, phospholipase, lipoxygenase, and cyclooxygenase) that control the formation of the biological mediators, responsible for the activation of endothelial cells and specialized cells involved in inflammation. Oranges are eaten to allay fever. The roasted pulp is prepared as a poultice for skin diseases.

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Chapter - 12

Health Benefits of Guava

Paramita Jana

Introduction

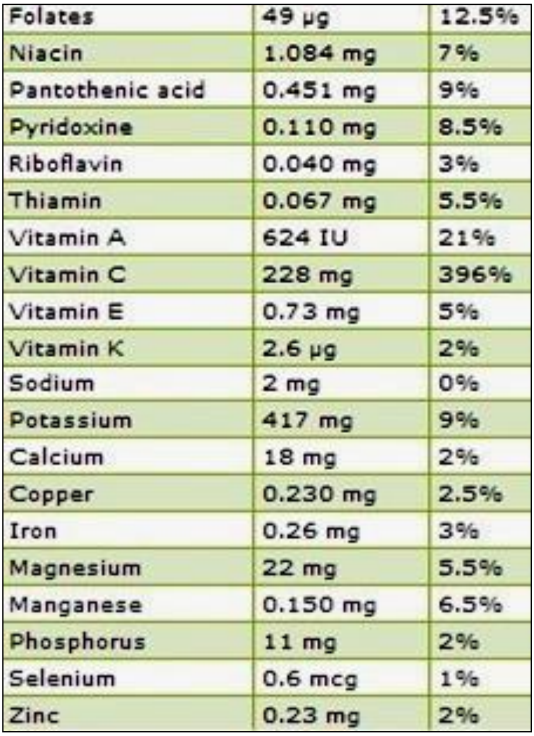
Guava is a tropical fruit produce by the guava tree. It is a common tropical fruit cultivated in many tropical and subtropical regions. Common guava is small tree in the myrtle family. The fruits commonly eaten fresh or made in to beverages, jams, and other foods. The fruit leaf, fruit juice are used as medicine. Guava fruits, usually 4 to 12 centimeters long, are round or oval depending on the species. They have a pronounced and typical fragrance, similar to lemon rind but less sharp. The outer skin can be any thickness, is usually green be for maturity but after maturity it may be yellow, maroon or green colour. The pulp in side may be sweet or sour and off white colour for white guavas and deep pink for red guavas. The seeds in the central pulp vary in number and hardness, depending on species.

Guava is an unusually source of ascorbic acid. Guava fruits contained

300 to 400 mg of Ascorbic acid per 100gm of fresh fruit. Three common enzyme ascorbic acid oxidase, peroxidase and phenoloxidase (phenolases) are presenting guava fruits that helps to maintaining digestive system. Large amount of guava fruit are produced in Brazil, Colombia, Venezuela and Mexico.

Nutritional Value in Percentage (Per 100 gm)

Table 1: Nutritional value of guava Source- Internet



Folates	49 μg	12.5%
Niacin	1.084 mg	7%
Pantothenic acid	0.451 mg	9%
Pyridoxine	0.110 mg	8.5%
Riboflavin	0.040 mg	3%
Thiamin	0.067 mg	5.5%
Vitamin A	624 IU	21%
Vitamin C	228 mg	396%
Vitamin E	0.73 mg	5%
Vitamin K	2.6 μg	2%
Sodium	2 mg	0%
Potassium	417 mg	9%
Calcium	18 mg	2%
Copper	0.230 mg	2.5%
Iron	0.26 mg	3%
Magnesium	22 mg	5.5%
Manganese	0.150 mg	6.5%
Phosphorus	11 mg	2%
Selenium	0.6 mcg	1%
Zinc	0.23 mg	2%

Type and Varieties

All guave trees are small trees with a single or multi- trunked growth habit, a molted bark and rounded shape. There are some different type of guava's are founded specially two type varieties type pink- red fleshed varieties and white and yellow Fleshed types. All types of guava trees are aromatic evergreen leaves and produce nice fragment and white colour flower clusters that later mature into fruits.

Variety

- **Pink and Red Fleshed Varieties**

These types of guavas are referred to as dessert guavas, pink and red fleshed guava’s produce sweet, intensely fragrant fruit. This type of guava noted for its sweet, high quality fruit, despite their seediness the fruit is good for eating raw.

- **White and Yellow Fleshed Varieties**

This type of guavas are typically produced mild acidic fruits with little to no fragananance. The flesh ranges from creamy white to pale yellow and the skin typically stays green when ripe, although some varieties develop a pinkish blush.

Type

- **Hong Kong Pink Guava**

A common pink fleshed variety is “Hong Kong Pink” which produces large quantities of mound, 6-8 ounce fruits. The pink flesh fruit ranges from sweet to mildly sub- acidic with a smooth texture and few seeds.

- **Homestead Guava**

A common variety is the “Homestead” guava, which produces of medium quantities of round with sweet, flavorful flesh featuring a deep salmon pink colour.

- **Red Malaysin Guava**

Red Malaysin guava is a great type of guava. It fruits is red color and the trees have red tinted leaves and very showy bright pink flowers.

The fruits are sweet flavour with low seediness. It is a great quality for eating raw.

- **Strawberry Guava**

The strawberry guava are close resemblance to the tropical guava are it produces similarly sweet, almost spicy fruit. The fruit is typically 1 to 2 inches in diameter with creamy white flesh and wrinkle red skin. It is suitable for cooking like jam and juices, as well as fresh eating.

- **Tropical White Guava**

Guava fruits are specially classified by the colour of the flesh, and this one is white in color variation. “Tropical white” produces a tender, sweet fruit with yellow skin and a pleasant aroma.

- **Mexican Cream**

The “Mexican Cream” known as ‘Tropical Yellow’. The fruit is very creamy and sweet and excellent for use in desserts.

- **Lemon Guava**

Lemon guava is also considered as strawberry guava. This tree also produces fruit with a district taste. The fruits are yellow with yellow flesh and flavor reminiscent of both guava and lemon.

- **Pineapple Guava**

The pineapple share a flavor similar to tropical guavas, but they have rough, dark, green skin even when ripe pineapple guava trees typically reach a mature height of 10 to 15 feet with an equal spread.

- **White Indian Guava**

White Indian guava produce small to medium size of fruit with pale flesh. It is noted for the sweet flavour fruit with somewhat fort and seedy fruit.

- **Detwiler**

Detwiler is unique for being the only yellow fleshed guava. It is currently not easy to find. It produces sweet smell.

Health Benefits

Guava is a super fruits because of the presence of multiple health benefits nutrients like vitamin, mineral, folic acid, Fiber, flavonoids and other phytochemicals.

It is surprising to know that guava produces more vitamin C than orange and more potassium than bananas.

- **Prevent Cancer**

Guava is one of the surprising fruits which are abundaril with cancer fighting antioxidant Lycopene. The phytochemical lycopene the cancer such as breast cancer. The higher amount and higher concentration of lycopene fights with free radical and prevents the risk of Cancer and heart diseases. The red fleshed guava is prefer for prevent cancer disease over other varieties of guavas. The antioxidant can help to prevent the formation of cancerous tumors. In guava the others nutrients like vitamin, fiber, β-carotene, plavonoids, lutein and cryptoxanthin along with antioxidants those are also help to fight free radical cells, which credit to cancer. Guava is plentiful of dietary fiber that aids in protecting of colon mucous which prevents which prevents toxins and cancer causing cells. Guava rich source of carotene which fight off lung and oral cancers too.

- **Diabetes Treatment**

Guava fruits and leaves have the power to lower blood glucose levels. It showed the positive result when the fruit, guava is eaten without skin. In japan, guava leaf tea is take to promote health and prevent diabetes as this helps to adsorb maltose and sucrose thereby control blood glucose level. In china, the peeled guavas are also taken treat diabetes.

- **Hypertension**

Guava is usually used for the treatment of heart diseases. And in that time it is highly useful for the treatment of blood pressure and Hypertension. Guava promotes good hearil health prevent stroke, heart attack, lowering the cholesterol level. Guava contains adequate fiber and also hypoglycemic in nature which helps to control blood pressure and cholesterol levels.

- **Skin Care and Beauty**

Guava enhance the skin texture, lightening the loosening skin and it also far better option than the nourishing lotions which available in local market. Regular eating the guava is best for skin treatment. The higher concentration of nutrients presence in guava help to makes the skin toned, fresh and wrinkle free. The astringent which present in guavas keep the skin away from blemished, acne, wrinkles and pimples. Guava also help to improve the lost of elasticity of the skin.

- **Weight Loss**

Guava is one of the important fruits that treat as a weight loss food. Guavas are rich in vitamin, minerals and dietary fiber with low CHO and no cholesterol. Eating guava in daily give you the satisfaction of fullness. If you want to lose your weight naturally, eat one or two guava at lunch time after meal. Guava leaves are also help to weight loss it considered as weight loss diet.

- **Constipation**

In guava high quantity of dietary fiber and roughage are present, that are extremely beneficial for constipation piles and hemorrhoids. Dietary fiber help in digestion and absorption of nutrients from food substances. Guava contain higher amount of insoluble fiber. A 100 gm of guava contain 36% of recommended daily intake of fiber. Guava seeds are powerful laxatives that help in chronic constipation and cleaning the digestive system. Eating more guavas may helps to healthy bowel moments and prevent constipation.

- **Diarrhoea**

Guava inhibits the microbial growth, releases excessive mucous from the intestine that helps to bind loose stools, so guava is beneficial food for the treatment of diarrhea. Chewing the guava leaves, remove extra mucous from the intestine.

- **Dysentery**

Guavas are alkaline in nature that prevent the growth of bacteria and having many disinfectant properties carotenoid vitamin C and Potassium are phytochemicals that acts like as disinfectant.

- **Relieve Painful Symptoms at Menstruation**

Taking guava leaf extract daily may help to decrease symptoms of painful menstruation. Some women have dysmenorrtua painful symptoms of menstruation such as stomach cramps, taking 6mg of guava leaf in daily help to reduce the pain intensity.

- **Boost Heart Health**

In guava the higher quantity of potassium are present that contribute to improved heart health. High levels of vitamins and antioxidant in guava leaves may protect herm health from damage by the free radicals. Guava leaf help to decrease the bad cholesterol (LDL) and rise in good cholesterol (HDL).

- **Acidity or Gastric**

Guava are alkaline in nature, guava act like as alkanity inside the body that properties help to treat of acidity and hyperacidity. The guavas juice are beneficial for health that release toxing from our body specially from the stomach.

- **Cold and Cough**

Guava leaves is a rich source of vitamin C and Iron that help to reduce the lungs congestion and mucous formation and makes the respiratory tract infection free. Guava leaves is beneficial for treating cough and cold and also help to fight dengue fever.

- **Toothache**

One guava contains 169mg of vitamin C more than orange, while an orange has only 69mg. For the high concentration of vitamin C, guava is very useful in the treatment of swollen gums and bleeding. Guava is rich in folate that prevents breath which is responsible for gum disease gingivitis Guava juice is one of the best homemade treatment for toothache.

- **Conclusion**

Guava is a good source of nutrients especially dietary fiber and vitamins. Presence of vitamin C can help to reduce toothache, cough intensity. The guava leaves is very beneficial like guava fruits. Guava can also protect our body by the cancer cell in the presence of phytochemical lycopene. Eating a guava in daily diet helps to reduce blood pressure, hypertension, and risk of heart attack, skin problem etc. The guava seeds also work as laxatives to treat constipation. Additionally guava leaf extract may benefit digestive system. Three enzyme ascorbic acid oxidase, peroxidase and phnolases present in guava that help to prevent acidity. Presence of many nutrients in guava, guava is a best choice fruit from other fruit to take. Guava is a good fruit to taken in daily diet.

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Chapter - 13

Health Benefit of Jackfruit (*Artocarpus heterophyllus*)

Twinkle Bhoi

Introduction

Jack is a tropical fruit species found in tropical, high rainfall, coastal and humid areas of the world. It belongs to family Moraceae. Scientifically Artocarpus heterophyllus, it is the favorite fruit of many, owing to its sweetness. The jackfruit tree is widely cultivated in tropical regions of India, Bangladesh, Nepal, Sri Lanka, Vietnam, Thailand, Malaysia, Indonesia and the Philippines. Jackfruit is also found across Africa, e.g., in Cameroon, Uganda, Tanzania, and Mauritius, as well as throughout Brazil and Caribbean nations such asjamaica. However, India is considered to be the native of jack fruit. The name originated from its Malayalam name Chakka. It is also called kathhal (hindi and urdu), pala (tamil), halasinahannu (kannada) panasapandu (telugu) and phanos (marathi and Konkani). The fleshy carpel which is botanically the perianth is the edible portion.

Nutritional and Medicinal Properties of Jack Fruit

- **Jack Fruit is Rich in Several Nutrients**

It can act as source of complete nutrition to the consumers. The fruit is equivalent to Avocado and olive in terms of the healthier mix of nutrients for human dietary needs, almost having the exact nutrient equivalents of mother's milk. It is rich in vitamin B and C, potassium, calcium, iron, proteins and high level of carbohydrates, affordable and readily available supplement to our staple food. Its seeds are rich in proteins and can be relished as a nutritious nut. The fruit is also the source of chemical "Jacalin" useful in preventing colon cancer, AIDS etc.

Nutritive Value of Jackfruit (100 gm)

Constituent	Average value
Moisture (%)	76.20
Energy(g)	88.00
Protein(g)	1.90
Fat(g)	0.10
Fiber(g)	1.109
Carbohydrates(g)	19.80
Potassium(mg)	107.00
Calcium(mg)	20.00
Phosphorous(mg)	41.00
Iron(mg)	0.56
Beta carotene(mg)	175.00
Thiamine(mg)	0.03
Riboflavin(mg)	0.13
Niacin(mg)	0.40
Vitamin C(mg)	7.00

Health Benefits of Jackfruit

- Jackfruit is an excellent source of vitamin C, which helps to protect against viral and bacterial infections.
- Protects against Cancer In addition to vitamin C, jackfruit is also rich in phyto-nutrients such as lignants, lisoflavones and saopnin which have anti cancer and anti aging properties.
- These phyto-nutrients may help eliminate cancer causing free radicals from the body and slow down the degeneration of cells that can lead to degenerative diseases.
- Aids in healthy digestion Jackfruit is also known to contain anti ulcer properties which help cure ulcers and digestive disorders.
- In addition, the presence of high fiber in the jackfruit prevents constipation and helps in smooth bowel movements.
- Maintains a healthy eye and skin Jackfruit contains vitamin A, a

powerful nutrient which is known to maintain a healthy eye and skin. It also helps prevent vision related problems such as macular degeneration and night blindness.

- Lowers high blood pressure Potassium contained in Jackfruit has been found to be helpful in the lowering of blood pressure and thus reducing the risk of heart attack as well as strokes.
- Strengthens the Bone Jackfruit is rich in magnesium, a nutrient which is important in the absorption of calcium and works with calcium to help strengthen the bone and prevent bone related disorders such as osteoporosis.
- Jackfruit also contains iron which helps to prevent anaemia and also helps in proper blood circulation in our body.
- Maintains a healthy Thyroid Jackfruit is loaded with copper, an important mineral, which plays a key role in the thyroid metabolism
- Potentially harmful in combination with alcohol, consuming it at the same time as alcohol can cause problems.scientists believe that sulfur-like compounds in it may prevent certain enzymes from breaking down alcohol, causing increased alcohol levels in your blood.this could lead to symptoms like nausea, vomiting, and heart palpitations.

Easy to Add to Your Diet

Jackfruit seeds can be enjoyed similarly to other seeds. Here are some easy ways to add them to your diet:

- Top salads with them.
- Make homemade jackfruit-seed hummus.
- Grind them into flour for use in baking or cooking.
- Add them into smoothies.
- Make homemade jackfruit-seed butter.
- Eat them alone as a snack.

Conclusion

Jackfruit is an exotic tropical fruit with a subtle sweet flavor that is consumed in many parts of the world. It can be eaten in a variety of ways. Jackfruit is quite healthy. It provides a moderate amount of calories in addition to lots of fiber, vitamins, minerals and antioxidants. Jackfruit has a low glycemic index and provides some fiber, protein and antioxidants, all of which may promote better blood sugar control. Jackfruit contains a variety of antioxidants that may be helpful for preventing the development of several chronic diseases, such as heart disease and diabetes. Adding jackfruit to your diet is worth a try, as it is quite healthy and a unique food to experiment with.

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Chapter - 14

Health Benefits of Apple

Puneet Aroa

Introduction

There has been an increasing appreciation and understanding of the link between dietary fruit and vegetable intake and improved health in humans. "An apple a day keeps the doctor away" is an old Welsh proverb that most of us are familiar.

Health Benefits are Associated with Eating Apples

The widespread and growing intake of apples and apple juice/products and their rich phytochemical profile suggest their important potential to affect the health of the populations consuming them. Apple has several health benefits, but this forbidden fruit from the Garden of Eden is also a great weight loss food. As one of the most cultivated and consumed fruits in the world, apples are continuously being praised as a "miracle food". A collection of research studies suggests that apples may well be one of the healthiest foods for you to include in your daily diet. Let's take a look at the studies and the possible health benefits suggested by them:

Improving Neurological Health

A 2006 study published in the journal Experimental Biology and Medicine found that quercetin (one of the antioxidants found abundantly in apples) was one of two compounds that helped to reduce cellular death that is caused by oxidation and inflammation of neurons. Another study presented at the same conference and published in the Journal of Alzheimer's Disease suggested that apple juice consumption may increase the production in the brain of the essential neurotransmitter acetylcholine, resulting in improved memory among mice who have Alzheimer's-like symptoms. It should be noted that both studies were funded by unrestricted grants provided by the U.S. Apple Association and Apple Products Research and Education Council.

Preventing Dementia

A study published in the Journal of Food Science in 2008 suggested that eating apples may have benefit for your neurological health. The researchers found that including apples in your daily diet may protect neuron cells against oxidative stress-induced neurotoxicity and may play an important role in reducing the risk of neurodegenerative disorders such as Alzheimer's disease.

Reducing Your Risk of Stroke

A study involving 9,208 men and women showed that those who ate the most apples over a 28-year period had the lowest risk for stroke. The researchers concluded that the intake of apples is related to a decreased risk of thrombotic stroke.

Lowering Levels of Bad Cholesterol

A group of researchers at The Florida State University stated that apples are a "miracle fruit". They found that older women who ate apples everyday had 23% less bad cholesterol (LDL) and 4% more good cholesterol (HDL) after just six months.

Reducing Your Risk of Diabetes

Apples could also help lower risk of diabetes. A study involving 187,382 people found that people who ate three servings per week of apples, grapes, raisins, blueberries or pears had a 7% lower risk of developing type 2 diabetes compared to those who did not.

Warding off Breast Cancer

There is growing evidence suggesting that an apple a day may help prevent breast cancer, according to a series of studies conducted by prominent Cornell researcher Rui Hai Liu. Liu said her research adds to "the growing evidence that increased consumption of fruits and vegetables, including apples, would provide consumers with more phenolics, which are proving to have important health benefits. I would encourage consumers to eat more and a wide variety of fruits and vegetables daily."

Obesity

In a study published in the journal Food Chemistry in 2014, a team of researchers analyzed how the bioactive compounds of seven different varieties of apples - Granny Smith, Braeburn, Fuji, Gala, Golden Delicious, McIntosh and Red Delicious - affected the good gut bacteria of diet-induced obese mice. The researchers found that, compared with all other apple varieties, Granny Smiths appeared to have the most beneficial effect on good gut bacteria. They suggest that their findings may lead to strategies that prevent obesity and its associated disorders.

Nutrition

Apples deserve to be called "nutritional powerhouses". They contain the following important nutrients:

Vitamin C - a powerful natural antioxidant capable of blocking some of the damage caused by free radicals, as well as boosting the body's resistance against infectious agents, according to the University of Maryland Medical Center. B-complex vitamins (riboflavin, thiamin, and vitamin B-6) - these vitamins are key in maintaining red blood cells and the nervous system in good health. Dietary fiber - the British National Health Service2 says that a diet high in fiber can help prevent the development of certain diseases and may help prevent the amount of bad cholesterol in your blood from rising. Phytonutrients - apples are rich in polyphenolic compounds". These phytonutrients help protect the body from the detrimental effects of free radicals.

Nutritional Value

Minerals such as calcium, potassium, and phosphorus.

Apples, with skin (edible parts) nutritional value per 100 grams.

Table: The average size of an apple is 150 grams

Energy	52 kcal	Folate (vitamin B9)	3 µg
Carbohydrates	13.81 g	Vitamin A equiv	3 µg
Fat	0.17 g	Vitamin C	4.6 mg
Protein	0.26 g	Vitamin E	0.18 mg
Water	85.56 g	Vitamin K	2.2 µg
Sodium	1 mg	Calcium	6 mg

Beta-carotene	27 µg	Iron	0.12 mg
Lutein and zeaxanthin	29 µg	Manganese	0.035 mg
Thiamin (vitamin B1)	0.017 mg	Phosphorus	11 mg
Riboflavin (vitamin B2)	0.026 mg	Potassium	107 mg

Source: USDA

Conclusion

Apple is a good source of vitamin C. Vitamin C is a powerful natural antioxidant capable of blocking some of the damage caused by free radicals, as well as boosting the body's resistance against infectious agents, according to the University of Maryland Medical Center. B-complex vitamins (riboflavin, thiamin, and vitamin B-6, these vitamins are key in maintaining red blood cells and the nervous system in good health. Apples could also help lower risk of diabetes.

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Chapter - 15

Health Benefits of Mango

Anjaneya Swain

Introduction

Mango is also known as by its botanical name *Mangifera indica*. Mango is one of the most popular among all the tropical fruits. Genus Mangifera consists of about 30 species of fruiting trees from which mangoes are cultivated because, these are edible. These mango fruits are believed to be originated from South Asian region. It is considered as the “King of fruits”. It is crowned as the national fruit of India and Pakistan and regarded as the national tree of Bangladesh.Amongst the other mango cultivating countries like China, Bangladesh, Pakistan, Thailand, Indonesia; India is the leading mango producer among them which is about 15000 metric tons based on the database of 2010-11 by Indian Horticultural Board.India’s share is around 50% of world total production of mango. The word mango is originated from the Malayalam word mangga during 15th centuries. In different languages the mango fruit is called as; mango in English, aam in Hindi, aam in Bengali, amba in Odia, maanga in Malayalam, aamkaay in Tamil. It is an evergreen, deep-rooted tree that grows up to a height 10-40 meters, typically heavily branched. These trees can survive for several hundred years under good climate conditions. Their leaves are evergreen, simple and alternate of size up to 35cm long and 16 cm wide. The leaves are orange pink in colour when they are young and gradually becomes dark green with age. The leaves are arranged in spiral manner.The canopy of the tree is normally oval or dome shaped. The root system is composed of long and vigorous taproots. The inflorescenceoccurs in panicles. The inflorescence is widely branched and can be up to 30cm long. It consists of hundreds of whitish red flowers with mild and sweet scent. These flowers are either monoecious or polygamous.Mango fruit is a seasonal or climacteric. Theflowering and growing period of mango is between December to April and the fruits are harvested during June. The fruits take about 4 to 5 months to grow and get ripened. These fruits are large in size containing edible mesocarp of varying thickness. The mesocarp is resinous and the exocarp is thick and glandular. The fruits are varying in shape and size also. It contains thick pulp, with single seed and oblong or elongated in shape. The immature fruit is green in colour which gradually changes to yellow, orange, red or combination of these colours, during maturing. The ripe fruit is also varying in their sweetness and eating quality. These fruits are 5-20cm length and about 2 kg depending on the cultivar. It consists a fleshy part which surrounds the shell containing seed.The seeds are ovoid or oblong in shape. The colour of the mango fruits is also of different shades of yellow, orange and reddish in colour. The peel colour varies with the verity of the mango fruits like ‘Dashehari’ and ‘Alphanso’ are yellow, ‘Bombay green’ is green etc. For commercial purpose the mango trees are now days reproduced via asexual means i.e. by grafting onto rootstock. This method also helps the farmer to produce different varieties.After harvesting, we can store these fruits for about 7 to 10 days at normal room temperature, but it is also varies depending on the climate condition. Its storage shelf life can be extended to about few weeks by storing in modified or controlled atmospheric conditions also.

Types of mango

- **Alphonsos -Ratnagiri / Devgarh Hapus, Maharashtra**

Alphonso Mango is one of the best variety of mango found in India in terms of sweetness and flavor. Maharashtra region of Ratnagiri, Devgarh, Raigad, and Konkan are the only place in western part of India where Alphonso Mango are cultivated and also one of the most expensive kinds of mango in India.

- **Badami – Karnataka Alphonso**

Badami mangoes are also called as Alphonso of Karnataka state, texture and taste are quite similar to other Mango from the region of Ratnagiri in Maharashtra as well as Alphonso of Karnataka.

- **Chaunsa – North India**

Chaunsa is one the sweetest mangoes grown in North India, It has medium oblong and has a golden yellow colour with a red blush. It mainly produced in Mirpur Khas Sindh in Punjab of Pakistan.

- **Dasheri – Malihabad, Uttar Pradesh**

Dasheri is delicious variety of mango basically grown in North parts of India, Its one of the very famous variety of mango in north India. Malihabad in Uttar Pradesh is the largest producer of Dasheri mango and along with other varieties of mangoes such as Chausa, Fazli, Lucknowa, Jauhari and Safeda.

- **Kesar – Saurashtra, Gujarat**

Kesar Mangoes is also simply called Gir Kesar because cultivar grown in the foothills of Girnar in the districts of Junagadh and Amreli.

- **Langra – Uttar Pradesh**

Langra is the prominent variety of mango and one of the most superior variety of Mango from the Northern India, Langra mangoes are originally from Varanasi, Uttar Pradesh.

- **Mulgoba – Tamil Nadu**

Mulgoba is one of the best mango grown in Tamil Nadu state and other parts of South India, Mulgoba is known as the “Alphonso of South India.

- **Neelam**

Neelam mango grows in many areas of India, usually found in abundance in June. These mangoes are a favourite in Hyderabad and also a famous varieties of mango from South of India along with Raspuri Mango.

- **Raspuri – Karnataka**

Raspuri are oval shape mango with excellent flavour and juicy in texture, considered as the Queen of Mangoes in India. Peddarasalu or Rasapuri as known in Karnataka.

- **Himsagar – West Bengal**

Himsagar Mangoes are the specialty of West Bengal and Orissa, Himsagar is one of the top five mangoes in India you should and must have along with Ratangiri Hapus, Banarasi Langda, Gir Kesar and Banganapalli.

- **Totapuri – South India**

Totapuri Mango is the famous mango found primarily in south Indian state of Andhra Pradesh, Karnataka and Tamil Nadu. Totapuri is one of the main cultivars grown in India.

- **Benishan Mango – Banganapalli, Andhra Pradesh**

Benishan Mango also known as Banganapalli is one of the most common cultivars of mango the town of Banganapalle in Andhra Pradesh. These mangoes are large is size and weighing on an average 350-400 grams hence known as known as The King of Mangoes in South India.

Nutritional Fact

Mango fruit is considered to a delicious fruit which comes with several nutritional and health benefits. Mango fruit contain several nutritional components such as carbohydrates fatty acids, minerals, organic acids, proteins and amino acids and vitamins. Before ripening the mangoes are acidic and rich in vitamin-C whereas after ripening it only contains a moderate level of vitamin-C in it, but fairly rich in vitamin- B and provitamin A.The distinctive flavour of mango fruit is due to several volatile compounds, but the major contributors are terpene, furanone. The malic acid and citric acid present in them, is reasn for the fruit acidity. In addition, there are pyruvic acid, oxalic acid, malonic acid, galacturonic acid present. The acidity of fruit is cultivar dependent.Apart from that, the sucrose is the principle sugar present in ripe mangoes. Free sugars including glucose, fructose and sucrose levels generally increases during ripening period. For example, the sucrose content of three Indian cultivar variety such as Alphanso, Pairie and Totapuri ranges from 11 to 20% (Popenoe, W., 1920). Mango fruits are low in calories, but rich in nutrients. One cup (165gm) of mango provides.

- Calories: 99
- Carbohydrates: 24.7 gm
- Proteins: 1.4 gm
- Fat: 0.6 gm
- Dietary fiber: 2.6 gm

- Vitamin A: 11% of the RDI
- Vitamin B_1: 4%of the RDI
- Vitamin B_2: 5% of the RDI
- Niacin: 7% of the RDI
- Vitamin B_5: 6% of the RDI
- Vitamin B_6: 11% of the RDI
- Vitamin C: 44% of the RDI
- Vitamin E: 9.6% of the RDI
- Vitamin K: 6% of the RDI
- Potassium: 5% of the RDI
- Magnesium: 4% of the RDI

It has also some small amounts of other minerals like calcium, phosphorus, iron present in them. One cup of mango can provide approximately 50-60% of the RDI for vitamin C which helps our body to absorb iron and for your growth and repair. It also contains polyphenols like quercetin, catechin, tannins etc. It has a unique xanthonoid called as mangiferin. Among these polyphenols mangiferin is more important because of its antioxidant activity. It also called as the "super antioxidant". Besides its nutritional richness, this fruit also offers several health benefits. Mango is a very good source of antioxidants. Antioxidants are important for us, as they protect your cells against free radical damage or cell damage caused due to these free radicals. Mangoes are considered good for digestion because of its high amount of fiber content. It helps to solve digestive problems like constipation and diarrhoea. Because of its richness with vitamin C and A mangoes are good for maintaining a healthy skin and hair. Vitamin C is essential for collagen production; a protein that gives structure to your skin and hair. It provides skin's elasticity and combats sagging and wrinkles.Vitamin A encourages hair growth because of its involvement in production of sebum, the oily substance that moisturize the scalp for healthy hair. Vitamin A also is essential for immune system, as it helps to prevent infections whereas vitamin C helps your body for producing more amount of white blood cells (WBC) which increased your skin's defence.

Mango is also found to be good for your heart as it contains magnesium and potassium which helps to maintain blood pressure. The antioxidants present in mango may also protect heart cells against inflammation and cell death, though several studies are still going on regarding this subject. The antioxidants present in mango helps in lowering the blood cholesterol level and keep your heart healthy. Different types food products like pickles, chutney, amchur etc are prepared by using raw mangoes. In case of ripened mango, it is mostly used for juice making and different flavoured ice-creams.Though with so much benefits, it also comes with some risks. Like, the most common problem regarding mango is artificial ripening which adversely affects your health. The basic symptoms related to it is tingling sensation, itching etc. It causes increase in blood sugar level if consumed excess. Excess eating can also lead to unnecessary weight gain.

Nutrient Composition & Health Benefits of Mangoes

- **Vitamin A (Carotene Pigments)**: Very good quantity Hence, consumption of mangoes is good for vision, immunity, reproductive health, and skin health and bone growth.
- **Vitamin C**: Mango contain high amount of vitamin C. Mangoes eating helps in improving cognitive and neurologic function, collagen formation, absorption of iron from intestines, immune function, wound healing, health of gums and teeth.
- **Folate**: mango is a good source folate vitamin. Consuming adequate quantities of mangoes helps in formation of red blood cells and DNA & supports healthy cardiovascular function. Eating folate before and during pregnancy may help reduce a woman's risk of having a child with a brain or spinal cord defect.
- **Fiber:** Mango is also good source of fibre. Fiber makes one feel full faster and therefore may help support weight management. Mango consumption aids digestion, controls constipation & slows the absorption of sugar into the blood stream. Hence Mangoes are excellent for normalizing gut functions & help in control of weight & diabetes.
- **Vit B6**: Mango is rich source of Vitamin B6. Vitamin B6 facilitates in immune function, cognitive development, maintaining normal blood sugar level, hemoglobin synthesis & maintaining normal nerve function.
- **Copper**: Adequate amount of copper is also present in mango. Copper helps to form red blood cells, in immune function & to maintain bone health.
- **Potassium:** Mango also contain good amount of potassium. Potassium is an important component of cell and body fluids that helps controlling heart rate and blood pressure.

Conclusion

Mango is a fruit with good nutritional value, supplying the human diet with good dietary fiber, calories, vitamins and minerals. It is rich with antioxidants which is very important for our health. No doubt it is right to be called as the “King of fruits”. There are also different varieties of mangoes which are equally nutritious and delicious. Apart from its healthy characteristics it also comes with several risks if consumed in excess, so it is a healthy fruit if eaten in limited quantities.

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Chapter - 16

Health Benefits of Watermelon

Praveen Sharma

Introduction

Watermelon (*Citrullus lanatus*) botanically considered as the fruit is belonging to the family Cucurbitaceae. Cucurbitaceae family ranks among the highest of plant families for number and percentage of species used as human food. The watermelon is also known as Tarbooz (Hindi and Urdu), Tarbuj (Manipuri), Kaduvrindavana (Marathi), Eriputccha (Telegu), Kallangadiballi (Kannada), Tormuj (Bengali), Indrak (Gujarati). Watermelon is originated from Kalahari Desert of Africa but nowadays cultivated abundantly in tropical regions of the world. According to the National Institute of Industrial Research, watermelon is cultivated in Uttar Pradesh, Himachal Pradesh, Rajasthan, Orissa, Gujarat, Punjab, Haryana, Assam, West Bengal, Karnataka, Orissa, Andhra Pradesh, Maharashtra and Tamil Nadu. This fruit contain high amount of water, that helps to prevent dehydration.

Watermelon belongs to the Cucurbitaceae or gourd family. It is a trailing annual with stems, as long as 400 cm and chayote. The roots are shallow (40-50 cm) and extensive (60-90 cm), with taproot and many lateral roots.

Watermelon is a warm season crop and is not chill-resistant The edible part of the fruit is the endocarp (placenta)

Scientific Names

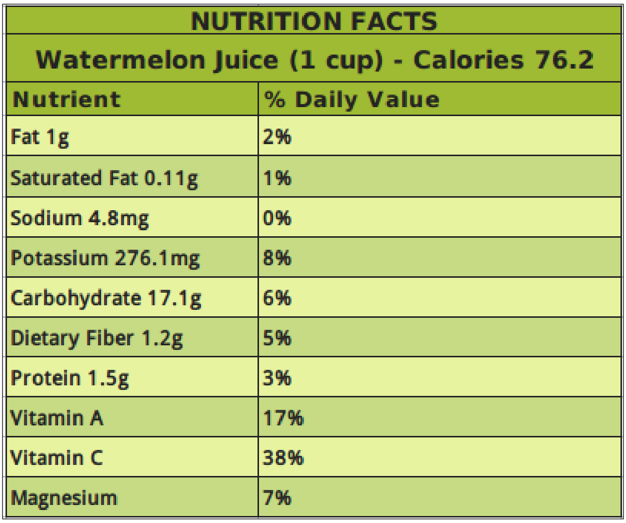
Table 1: Scientific Names of watermelon (Source- Internet)

Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Order: Cucurbitales
Family: Cucurbitaceae
Scientific name: Citrullus lanatus
Synonyms: Citrullus vulgaris
Genus: Citrullus
Species: Lanatus

Nutritional Value of Fresh Watermelon

Watermelon is one of the commonly consumed fruits in many countries. Watermelon contains more than 91% water and up to 7% of carbohydrates. It is a rich source of lycopene and citrulline. Watermelon rind contains more amounts of citrulline then flesh. Additionally, watermelon has a number of essential micronutrients and vitamins.

Table 1: Nutritive value per 1 cup (Source- Internet)



NUTRITION FACTS

Watermelon Juice (1 cup) - Calories 76.2

Nutrient	% Daily Value
Fat 1g	2%
Saturated Fat 0.11g	1%
Sodium 4.8mg	0%
Potassium 276.1mg	8%
Carbohydrate 17.1g	6%
Dietary Fiber 1.2g	5%
Protein 1.5g	3%
Vitamin A	17%
Vitamin C	38%
Magnesium	7%

Health Benefits of Watermelon

- **Energy Production**

Watermelon is rich in the B1 and B6 vitamins necessary for energy production. Because watermelon has a higher water content and lower calorie content than many other fruits, a whole cup of watermelon (contains only 48 calories) delivers more nutrients per calorie which is an outstanding health benefit.

- **Against Heart Disease**

Watermelon is rich source of lycopene that is very effective in protection of cell from damage and lower the risk of heart disease. If the person intake adequate amounts of watermelon juice then the person easily control the body weight and pressure. Watermelon extracts also helps to reduce hypertension in obese adults. Watermelon fruit is also a good source of potassium. Potassium is an important component of cell and body fluids that helps controlling heart rate and blood pressure. Thus, it prevents against stroke and coronary heart diseases.

- **Anti-Inflammatory and Antioxidant Support**

Anti-inflammatory foods can help with overall immunity and general health. The lycopene in watermelon makes it an anti-inflammatory fruit. Lycopene is an inhibitor for various inflammatory processes and also works as an antioxidant to neutralize free radicals. It also contains a good amount of vitamin-B6 (pyridoxine), vitamin C and manganese. Vitamin C rich fruits help the body to develop resistance against infectious agents and scavenge harmful oxygen-free radicals. Manganese is used by the body as a cofactor for the antioxidant enzyme, superoxide dismutase. Watermelon is an excellent source of Vitamin A, which is a powerful natural antioxidant. It is one of the essential vitamins for vision and immunity.

- **Improve Digestion**

The watermelon contains fibre, which encourages a healthy digestive tract and help to prevent constipation.

- **Against Dehydration**

Watermelon is a good example of fruit that contain high amount of water and electrolytes that helps to keep the body cool and hydrate.

- **Skin and Hair Benefits**

Watermelon also contains Vitamin A that helps keep skin and hair moisturized and it also encourages healthy growth of new collagen and elastin cells.

- **Cancer Prevention**

Like other fruits and veggies, watermelon may be helpful in reducing the risk of cancer through their antioxidant properties. Lycopene has been linked to reducing prostate cancer cell proliferation (National Cancer Institute.)

- **Macular Diseases**

Macular degenerative disease onsets with the thinning of macula layer of retina thereby resulting in gradual decrease in vision. The symptoms include appearance of yellow spots. The utilization of carotenoids or their rich sources can reduce the risk of macular and other degenerative disorders. In an experimental study of macula-degeneration, subjects with low lycopene-serum concentrations were at high risk. Lycopene is also effective against immunodeficiency diseases like HIV and cerebral damage microangiopathy in Austrian stroke.

- **Muscle Soreness**

Watermelon and watermelon juice have been shown to reduce muscle soreness and improve recovery time following exercise in athletes. Researchers believe this is likely due to the amino acid L-citrulline contained in watermelon.

Conclusion

Watermelons are very good source of important nutritive components and contained a very high concentration of nutrients for human consumption. It also contains different components of medicinal values. Therefore, it would be\more effective in healthcare management. Additionally, watermelon rind and seed is a rich source of an important amino acid and minerals. These exceptional qualities of watermelon and its products warrant us to use it for health benefits.

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Chapter - 17

Palmyra and Its Beneficial Effects

Saloman Behera

Introduction

The Palmyra palm tree is a dioeciously plant India stands first in the world in terms of its wealth of Palmyra palms with a population nearly 122 million palms.

The palm is found growing in Andhra Pradesh, Tamil Nadu, Bihar and Orissa and more number of palms is found in southern states of India. Palmyra palm has great economic potential and every part of the palm is use full in one way or the other more than 88% of the Palmyra is used for the welfare of the people, it serves as food (fruit, sap, young shoots) as a building material (the stem, the leaves) It is also used in the pharmacopoeia (roots, male inflorescence) and the leaves are used to make a variety of objects, brooms, baskets, fences and roofs palm wine extracted from Palmyra plays an importation role in the diet.

General Classification

Kingdom: Plantae
Order: Arecales
Family: Arecaceae
Tribe: Borasseae
Genus: Borassus
Spesies: *Flabellifer* L

Introduction about Fruit

The fruit (Palmyra fruit) measures 10 cm (3.9 in) to 18 cm (7.1 in) in diameter, has a black husk, and is borne in clusters. The top portion of the fruit must be cut off to reveal the sweet jelly seed sockets, translucent pale-white, similar to that of the lychee but with a milder flavor and no pit. The sweet jelly seed sockets occur in combinations of two, three or four seeds inside the fruit. The jelly part of the fruit is covered with a thin, yellowish-brown skin. Sugar palm fruit is especially rich in phosphorus and calcium with zero fat and negligible protein content. The soft orange-yellow mesocarp pulp of the ripe fruit is sugary, dense and edible, rich in vitamin A and C. BORASSUS also contains bitter compound called flabelliferrins.

Fruits mature during august and the ripe fruits fall from the palm during September and October. Each female palm may bear 10-20 bunches of about 200-300 fruits per year. When the fruit is very young, and the top of the fruit is cut off, you find usually three sockets inside and these contain he kernel which is soft as jelly, and translucent like ice, and is accompanied by a watery sweetish liquid. The mature fruit is usually tossed over low burning fire or embers to cook them mildly and the skin is peeled off to expose the juicy fruit. This is squeezed and the pulp removed. The pulp in itself is sweet and creamy and is delicious to eat. The pulp is usually sucked directly from the fibers of the fruit.

Functional Properties

The colour of the pulp is light orange colour and gives orange colour wavelength in spectrophotometer. The solubility of the pulp is partially soluble in water, alcohol and acid solutions completely soluble in ether and chloroform. The pH of palmyrah fruit pulp powder is slightly acidic i.e. pH range between 5 to 6 as shown in Table 1. The T.S.S. of the fresh pulp is 16-16.5 Brix, with these desirable characteristics; the pulp can be used for food additive to enrich nutritional values.

Water Absorption Capacity: The water absorption capacity for the Palmyrah pulp powder was 18% (2.5 ml/g) (Table 1). Water absorption capacity describes pulp water association ability under limited water supply. Thus Palmyrah pulp powder could be used in bakery industry.

Bulk Density: Bulk density is depended upon the particle size of the samples. The value obtained from the study was 0.78 g/cm3 (Table-1). Bulk density is a measure of heaviness of a pulp sample. It is important for determining packaging requirements, material handling and application in wet processing in the food industry. Since pulps with high bulk densities are used as thickeners in food products, the Palmyrah pulp pulp could be used as a thickener.

Swelling Power: The Palmyrah pulp powder has swelling power value of 4. Swelling power is a measure of hydration capacity, because the determination is a weight measure of swollen starch granules and their occluded water. Food eating quality is often connected with retention of water in the swollen starch granules.

Foam Capacity (FC): The foam capacity of the Palmyrah pulp pulp is shown in Table 1. The per cent foam capacity is about 2.5% which is lower in general. Foamability is reported to be related to the amount of solubilized protein.

Table 1: Functional Properties of Palmyra Fruit Pulp

Parameter	Values
Colour	Light orange
Solubility	Completely soluble in ether and chloroform
PH	5.5 to 6
T.S.S	16.5 Brix
Water absorption capacity (%)	3
Fat absorption capacity (%)	2.8
Bulk density (g/cm3)	0.78
Swelling Power (g/g)	4
Foam capacity (%)	2.5

Physico-Chemical Composition of Pulp from Palmyra

The ripped fruits data showed that 74% of them were large 3 seeded fruits with weight ranging from 450 g to 2200 g and a mean weight of 950 g of the remaining 18% were two seeded fruits and 8% were single seeded fruits were around 300 g in weight. In this study the average weight of palmyrah a seed was found to be 214 g and the average pulp weight per fruit was about 350 g ripe fruits and their seeds are used on a fairly large and profitable scale.

Moisture: Moisture provides a measure of the water content of the pulp and for that matter its total solid content. It is also an index of storage stability of the pulp. The moisture content of the fresh pulp was 74.77% (Table 1). The lower the moisture content, the better its shelf stability and hence pulp should be dried for storage.

Crude Fat: The fat content of the Palmyrah fresh pulp was 0.8% (Table 2). This value is relatively high when compared to other pulps and similar to that reported by Sankaralingam *et al*.

Crude Ash: The per cent ash content of the pulp was 1.20% (Table 1). The ash content is the organic residue remaining after the organic matter has been burnt away. It is not necessarily of exactly the same composition as the mineral matter present in the original pulp as there may be losses due to volatilization or some interactions between constituents.

Crude Protein: The per cent crude protein of the pulp was 1.236% (Table 2). The value obtained was however lower than that obtained by Sankaralingam *et al*. The difference observed may be contributed by varietal differences, maturation of the seeds and environmental conditions.

Carbohydrate: The major component of the pulp was carbohydrate. The value obtained from the study was 22.5% on fresh pulp and it shows higher carbohydrate content (Table-2).

Table 2: Physiochemical Properties of Palmyra Fruit Pulp

Parameter	Values for 100 g
Moisture	74-77%
Ash	1.2 g
Fat	0.8 g
Total Carbohydrates	22.5 g
Reducing sugar	9.5 g
Non Reducing Sugar	13 g
Starch	12.6 g
Maltose	0.5 g
Protein	1.24 g
Ascorbic acid	16 mg
Calcium	8.76 mg
Energy	102.83 k.cal

Health Benefits of Palmyra Fruit

Being rich in minerals and vitamins, sugar palm fruits are a healthy option for people on diet or suffering from diabetes. It is a rich source of vitamins B and C, iron, zinc, potassium, calcium, phosphorus, thiamine, and riboflavin. Listed below are few of the popular health benefits of Palmyra Fruit

1. Helps Relieve Digestive Problems

Palm fruit is a natural remedy for several stomach ailments and digestive problems. It helps in relieving constipation and in promoting normal bowel movements. It also helps in preventing acidity and stomach ulcers. Pregnant women are encouraged to eat ice apple, for it helps ease some of the minor stomach ailments and nausea that often occur during pregnancy.

2. Helps Relieve Skin Related Problems

Palm fruit is an excellent cure for some of the common skin problems that arise during the hot summer season, such as heat rashes and prickly heat. Applying the flesh of the fruit on the affected area provides soothing effects and relief from these conditions. It also helps relieve the itchiness associated with these heat related problems. The anti-inflammatory properties of the fruit are helpful in treating redness of the skin due to intense heat. Poultice made from palm fruit is found to be effective in treating dermatitis. It can be used safely in babies as well.

3. Cools the Body

Palm fruit is a natural coolant and helps to keep the body cool during summer. It also helps in preventing a number of heat related problems like prickly heat, dehydration, dry skin, kidney failure and hair loss. Not only does it hydrate your body, but it also helps replace the nutrients and electrolytes that are lost due to excessive sweating. Ice apple satisfies your thirst and provides you with the energy to stay active throughout the day.

4. Helps Reduce Weight

Ice apple is a low calorie fruit and is thus beneficial for people trying to lose weight. The fruit is rich in water content, which helps keeps your stomach fuller for a long period of time. This in turn helps in preventing frequent snacking, which is important in maintaining a healthy weight

5. Heals Migraines

Migraine is the most painful of all headaches. Natural medicinal content of palm jaggery helps to reduce this pain. Just take 1 tsp. of palm jaggery, and you will experience relief from migraine.

6. Prevention of Diabetes

Due to the low Glycemic Index of palm sugar, it is a healthy substitute for artificial sugar thus helps to prevent the onset of diabetes. Palm sugar consumption has been reported not to cause a sudden spike in the blood sugar levels. However, diabetes patients should consider consuming palm sugar at a very low level.

7. Home Remedy for Many Ailments

Palm fruit has anti-inflammatory and anti-oxidant properties. The fruit pulp helps to cure skin inflammations. It is used to treat nausea and vomiting as well as worm infestation. It is used as an expectorant and also as a liver tonic.

8. Rich in Phyto Nutrients

Palm fruit is rich in several phyto chemicals that possess strong antioxidant and anti-inflammatory properties. These compounds can help in slowing down the process of aging and in lowering the risk of many serious health problems such as heart disease and cancer.

Traditional Uses and Benefits of Palmyra Fruit

- There are innumerable medicinal uses for all parts of the Palmyra palm in traditional local medicine.
- Young plant is said to relieve biliousness, dysentery, and gonorrhea.
- Young roots are reported to be diuretic and anthelmintic, and a decoction is given in certain respiratory diseases.
- Ash of the spadix is taken to relieve heartburn and enlarged spleen and liver.
- Bark decoction, with salt, is used as a mouth wash, and charcoal made of the bark serves as a dentifrice.
- Sap from the flower stalk is prized as a tonic, diuretic, stimulant, laxative and anti-phlegmatic and amoebicide.
- Sugar made from this sap is said to counteract poisoning, and it is prescribed in liver disorders.
- Candied, it is a remedy for coughs and various pulmonary complaints.
- Fresh toddy, heated to promote fermentation, is bandaged onto all kinds of ulcers.

- The cabbage, leaf petioles, and dried male flower spikes all have diuretic activity.
- Pulp of the mature fruit relieves dermatitis.
- Decoction is given in certain respiratory diseases.
- Dried roots can also be smoked to heal nasal complaints.
- Ash of the flower is taken to relieve heartburn and enlarged spleen and liver.
- Bark decoction, with salt, is used as a mouth wash.
- Charcoal made of the bark serves as a dentifrice.
- Sugar made from this sap is said to counteract poisoning and it is prescribed in the treatment of liver disorders.
- It is also useful as an anti-inflammatory and for dropsy and gastric conditions.
- It also has potential immune-suppressive action.
- Root is pounded and a paste is prepared adding rice water. This paste is consumed in a dose of 5-6 g to treat diarrhea.
- The paste can also be rubbed over the navel region to treat diarrhea.
- Gargling with the decoction of the tree bark along with pinch of salt is used to treat gingivitis and oral ulcers.
- Jaggery prepared from the juice is used as a good tonic to strengthen the uterine muscles in post-partum women.
- Juice of the leaf stalks and young root is good for gastric catarrh and hiccough.
- Milky fluid from the immature seeds is sweet and cooling and prevents hiccups and sickness.

Culinary Uses

- Small fruits are pickled in vinegar.
- Fibrous outer layer of the ripe palm fruits are also boiled or roasted and eaten.
- Gelatinous translucent pale-white, endosperm of young fruit is juicy, nutritious and edible and is a refreshing delicacy in India and Sri Lanka and Southeast Asia.
- Shell of the seed can be punctured with a finger and the sweetish liquid sucked out for refreshment like coconut water.

- Tender nutritious endosperm is also canned in Thailand and exported globally.
- It can also be roasted, sundried, conserved and boiled.
- Jams and cordials are also being tried in Sri Lanka.
- Palmyra fruit pulp (PFP) is widely used to manufacture many food products including dried PFP (punatoo), which has been consumed in North-East Sri Lanka for centuries.
- Sprouts consisting of the first tender leaves and fleshy hypocotyl from fresh germinated nuts provide a rich source of vegetable starch and are boiled for immediate consumption or dried or conserved or roasted and pounded to make a meal.
- The sprouts are known as Panai Kizhangu or Panamkizhangu in Tamil.
- Germinated seed’s hard shell is also cut open to take out the crunchy kernel which tastes like a sweeter water chestnut.
- Tender apical bud is tasty and high prized and delicious.
- Fusiform roots are also eaten especially in times of famine.
- Young fleshy roots are baked and eaten.in Andhra Pradesh.
- Palmyra fruit pulp which is regarded as a waste product, appeared to be best used as an alcoholic fermentation base, with the possibility of using the carotenoids (by-product) as a food colorant.
- Sprouted seedlings of Palmyra palm can also be eaten raw, cooked, or sun-dried for later consumption.
- Salt can be made from the leaves.
- Fruit can be consumed raw or cooked.
- The immature fruits are pickled.
- Tender flesh of young fruits is cooked in curry.
- Ripe fruit has a yellow edible pulp with a distinctive aroma.
- Mature fruit is soaked in water, after which the wiry fibers are extracted, the yellow pulp mixed with rice starch, this is then folded inside a banana leaf and later steam-cooked.
- Sugar-rich sap is obtained from the inflorescence.
- Juice can be drunk, or concentrated by evaporation to form sweet syrup or a solid palm sugar known as jaggery.

- Soft upper 10 meters of the trunk consists of some starch, which may be harvested in times of food scarcity.
- The young solid or gelatinous endosperm of the seeds is eaten fresh or in syrup.
- Sprouted seedlings can be peeled and eaten raw or cooked.
- Inflorescence can be cooked and added to soups and curries.

Medicinal Properties of Different Parts of Palmyra Plant

All things that are created by God are good in their own way. There are few trees, animals, birds, reptiles, insect have extraordinary role to play in the universe. One of such role is being medicinal. This is greatly valued by everyone under the sun. Trees are in general medicinal as we know from our indigenous knowledge. This knowledge is expanded when we go for research part by part and inch by inch. The numerous researches undergone with the Palmyra tree is praise worthy. The parts of the tree and their medicinal properties are compiled here.

Roots: Young roots are diuretic and anthelmintic and a decoction is given in certain respiratory diseases (Hiralal Jana *et al*., 2017). The roots of the plants are cooling, curative and diuretic (Arunachalam *et al*., 2011). The nutritional analysis of the roots has shown 8.54% protein content, 23.53% carbohydrates, 7.29% crude fibre and negligible fat content. These roots are found to be high in calories (Sahni *et al*., 2014).

Bark or Stem: The bark decoction, with salt, is used as a mouth wash, and charcoal made of the bark serves as a dentifrice (Morton, 1988).

Fruit: Palm fruit has anti-inflammatory and antioxidant properties. The antioxidant activity could be attributed due to the presence of high content of crude flavonoids, saponins and phenolic compounds (Pramod *et al*., 2017). The fruit pulp helps to cure skin inflammations. It is used to treat nausea and vomiting as well as worm infestation. It is used as an expectorant and also as a liver tonic. A thin layer of sugar palm fruit jelly applied on the affected area has a soothing effect and immediately alleviates the itchiness associated with prickly heat. Being rich in minerals and vitamins, sugar palm fruits are a healthy option for people on diet or suffering from diabetes. It is a rich source of vitamins such as B, C and rich in minerals such as iron, zinc, potassium, calcium, phosphorus, thiamine, and riboflavin. During summers use palm fruit, to keep body hydrated. It also replenishes the lost minerals and nutrients of the body and prevents painful urination and tiredness in the body. It is used effectively to treat digestive problems and other stomach ailments. It is also used as a laxative. Sugar palm fruit is a good option for those who are on a diet. It also prevents malnutrition in children and adults. It is found that this tree has ascorbic acid the natural vitamin (Vengaiah *et al.*, 2013). The fruits are cooling, laxative, anthelmintic and sedative and also used as aperients and to improve the digestion (Rajendran *et al.*, 2008).

Leaves: Present researches show that consuming leaves, bark, roots have role to play in promoting as well as disease preventing benefits because of a few substances namely phytochemicals viz. polyphenols, vitamins, minerals, proteins, etc. (Prasad *et al.*, 2016) (Fig. 2).

Palm Sugar: Sugar palm fruit is also beneficial in treating inflammatory skin problems such as redness due to intense heat. A face pack made from sugar palm fruit is excellent for the skin even for people with sensitive skin. It prevents prickly heat, boils and redness of-the-face. Palm jaggery is also known as Palmyra palm sugar and is a natural sweetener. It is also a low calorie sugar. It is used extensively in cooking and has many health benefits; Low glycemic index sugar in the palm sugar is exceedingly helpful in reducing obesity and diabetes, it also provides a sustained and uniform energy supply to the body, and it is rich in many nutrients such as vitamins B1, B2, B3, B6 and C (Vivek *et al.*, 2011).

Spadix: Dennis *et al*. (2011) in his work on the Palmyra tree has found that the ash of the spadix of the Borassus flabellifer is taken to relieve heartburn and enlarged spleen and liver.

Flower: Sap from the flower of the matured tree stalk is prized as a tonic, diuretic agents, stimulant, laxative and anti-phlegmatic and amebicide that are considered to be the best for day to day life. Sugar made from this sap is said to counteract poisoning, and it is fairly prescribed for liver disorders. The ethanolic extract of male flowers (inflorescences) of Borassus flabellifer L. (Arecaceae) has analgesic activity (Shirisha *et al.*, 2018), (Gummadi *et al.*, 2016). Inflammation is a local response of living mammalian tissues to the injury and a body defense reaction in order to eliminate the spread of injurious agents. The ethanolic extract at doses of 150 and 300 mg/kg showed the antiinflamatory response in the mice (Paschapur *et al.*, 2009).

Sap and Toddy: It is obtained by tapping the top shoots and collecting the dripping juice in hanging earthen pots tied with the trees. The juice early morning is refreshing and is light. The drink has high nutrient value and is good for health (Bhaskar *et al.*, 2017). This drink is called Thaati Kallu in Telugu, Neera in Marathi and Pathaneer in Tamil. It is extremely cool in sensation and it is sweet in taste. The juice collected in the evening or after fermentation becomes sour. It is consumed mostly by coastal villagers of Maharashtra as a raw alcoholic beverage. Antifungal activity on Candida albicans and Aspergillus niger was determined by zone of inhibition at specific volumes (0.25, 0.50, 0.75 and 1.0 mL) of Sap of Borassus flabellifer. The significant antifungal activity was determined by using nutrient agar media and cup plate method (Singh *et al.*, 2016). Another sugary sap called toddy is obtained from the young inflorescence of male and female trees. Toddy is fermented to make a beverage called arrack. It is known as Pana Vellam or Karuppukatti among Tamils. Arrack or Pana Vellam is one of the highly sold product in many of the places especially in Tamil Nadu in the name of organic food in the shops named as "Namma Kadai" which means "Our Shop" where all the products that are produced or cultivated organically. Fresh toddy heated to promote fermentation is covered onto all kinds of ulcers (Jana *et al.*, 2017). In addition to these, the tree sap is taken as a laxative and is believed to possess medicinal virtues have also been ascribed to other parts of the plant. The 'neera' and toddy are good for controlling gastric troubles and ulcers. The inflorescences are widely used in Ayurvedic medicines. Wine was produced using the toddy of Borassus flabellifer in Sri Lanka and it has antimicrobial activity (Theivendirarajah *et al.*, 1987). Toddy contains nutritive value with Vitamin A, Ca, Fe, Zn, Cu and the fermented sap results in increased levels of Thiamine, riboflavin and niacin (Merugu *et al.*, 2014).

Seed: The antibacterial activity of methanol extracts of Borassus flabellifer L. (Arecaceae) seed coat (soft outer shell) was noted by agar well diffusion method *in vitro*. The antibacterial potential was examined against Gram-positive bacteria, i.e., Staphylococcus aureus, Bacillus subtilis and Gram-negative bacteria, Klebsiella pneumoniae and Serratia marcescens. The methanol extract of the seed coat showed consistently significant inhibitory activity on different bacterial species tested (Shirisha *et al.*, 2018).

Sprouts: The sprout is known as Thegalu or Gaygulu in Telugu, as Panai Kizhangu or Panang kizhangu in Tamil in Tamil. In India particularly Tamil Nadu, Andhra Pradesh, Telangana and Bihar, and in Jaffna, Sri Lanka, the seeds are planted and made to sprout and the fat stems (below the surface) are boiled or roasted and eaten. The stem of the sprout is very fibrous and nutritious (Shirisha *et al.*, 2018).

Other Facts

- Tree yields a black timber with desirable unique properties – hard, heavy, and durable and is highly valued for house construction, particle board, and furniture or made into handles, sticks.

- Timber and leaves are also used as fuel wood.
- Chopped leaves are used as green manure in rice fields.
- Leaves are seasoned, dried and used for thatching, mats, baskets, fans, hats, umbrellas, and as writing material.
- Leaves are formerly used in the ancient culture as papers, known as lontar in Indonesia.
- Leaf petioles are used to make fences and also produce a strong, wiry fiber suitable for cordage, baskets and brushes.
- Palm yields five types of fiber a loose fiber from the leaf base, a long fiber from the leaf stalk, a fiber from the interior of the trunk, fiber coir derived from the fruit pericarp and the fibrous material from leaf.
- Fibers, extracted from the leaf bases, are used in the manufacture of many types of brushes.
- Fibers from the midrib of the leaf are used to make brooms.
- Fibers for weaving are obtained from the adaxial part of the petiole and from leaves not yet unfolded.
- Fibers extracted from the frond bases exhibit valuable qualities of resistance to chemicals, termite and water and are exported from the provinces of Andra Pradesh, Tamil Nadu, and Kerala.
- Tender fruits that fall prematurely are fed to cattle.
- Roots, the sap of the plant, and the pulp serve medicinal purposes.
- In India also planted in windbreaks.
- It is also used as a natural shelter by birds, bats and wild animals.
- Recent studies reported that palmyra palm fruit shell extract inhibited the corrosion of mild steel and could have industrial application.
- Leaves have a wide range of uses, such as thatching for house roots and walls, weaving into baskets, mats and many other items.
- Top young leaves are made into hats, boxes to store rice, baskets, fans, etc.
- Bark fiber can be used to make strong ropes.
- Petioles are often used as poles for fencing.
- Dried leaflets were at one time used as a paper to record Indian holy texts.

- Whole trunk can be made into a small boat capable of carrying at least three people.
- The Palmyra tree is the official tree of Tamil Nadu.
- In Indonesia the Palmyra tree is the symbol of South Sulawesi province.
- Stalks are used to make fences and also produce a strong, wiry fiber suitable for cordage and brushes.
- In Cambodia, the trunks are also used to make canoes.
- Skin of the stem can be peeled off and be used as rope and also used to weave into cots.
- Leaves are used to make hand fans in the eastern part of India.

Conclusion

The golden words of the elders who have lived and gone are fulfilled with current science in many ways especially with regard to the medicinal properties of many trees on the earth. Palmyra tree is one such type of the tree highly foreseen by the people. There were times people considered this palm tree as God because of their benefits. It is one of the trees which used completely for various needs such as housing, medicine, shade and food. The pathetic situation is that they are drastically reduced in number due to amassing lands for buildings and other purposes in many of the places particularly in southern part of india where it is considered as the tree of the people. This article throwed some light on the antimicrobial activity, anti-inflammatory, anti-oxidant and analgesic activity. It is also used as a medicine for wound healing, immunomodulatory, malaria, syphilis, antiperiodic, heart burns, liver and spleen enlargement. Thus Palmyra tree is one of natural medicine that the parts of it can be used for treatment of various ailments**.**

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Chapter - 18

Papaya: Its Nutritional Facts and Health Benefits

Bipin Kumar Singh

Introduction

The papaya is the plant *Carica papaya*, one of the species in the genus *Carica* of the family *Caricaceae.* Papaya grows in tropical climates and also known as papaw or pawpaw. The papaya, a previously exotic and rare fruit, now it is available at most times of the year. Papaya is native of Mexico. However, it grows naturally in the Caribbean, Florida, North America and Central America. In 2016, global production of papayas was 13.05 million tonnes and led by India with 44% of the world total production. Papaya fruits are a soft and fleshy fruit that can be used in a wide variety of culinary ways. It has sweet taste, vibrant colour, and the wide variety of health benefits.It can be added to salads, smoothies, and other dishes. It contains zeaxanthin, an antioxidant found in papaya, it filters out harmful blue light rays. Papaya skin, seeds and pulp contains a variety of phytochemicals such as carotenoids and polyphenols with benzyl isothiocyanates, skin and pulp levels papayaincreases during ripening. Papaya seeds also contain the cyanogenic substance prunasin. Papaya leaves are used in a traditional medicine, it leaves have been used as a treatment for malaria, an abortifacient, a purgative, or smoked to relieve asthma. Papaya fruits are also used as a medicine. Fresh papaya is with reddish orange skin that are soft to the touch. The seeds of the papaya are edible but have a bitter taste. The nutrients found in papaya are thought to have a various health benefits. They may help protect against a number of health benefits because it contains vitamin A, vitamin C and minerals like magnesium, copper.

Nutrition Sources of Papaya Fruits

1. Papaya is an excellent source of vitamin C.
2. It is a good source of vitamins A (in the form of carotenoids).
3. It is a good source of folate.
4. It is a good source of pantothenic acid.
5. It is a good source of magnesium.
6. It also contains copper.
7. It is a good source of fibre.
8. Papaya contains choline.
9. Papaya also contains B vitamins, ά and β-carotene, vitamin E,vitamin K, lutein and zeaxanthin, calcium, potassium and lycopene

Nutritional Value of Papaya Fruits

One medium papaya has (approximately):

- 120 calories
- 30 grams of carbohydrate –it includes 5 grams of fiber and 18 grams of sugar.
- 2 grams of protein

Chemical Composition of Papaya Fruits

Raw papaya fruits contain 88% water, 11% carbohydrates and negligible amount of fat and protein. In a 100 gm amount, papaya fruit provides 43 kilocalories (Kcal) and is a significant source of vitamin C and folate.

Nutritional Value of Papaya Fruits (per 100g)

Constituents	Per 100g
Energy	43 kcal
Dietary fibre	1.7g
Carbohydrate	10.82g
Sugar	7.82g

Fat	0.26g
Protein	0.47 g
Vitamins	
Thiamine (B1)	0.023 mg
Riboflavin (B2)	0.027 mg
Niacin (B3)	0.357 mg
Pantothenic acid (B5)	0.191 mg
Folate (B9)	38 µg
Vitamin C	62 mg
Vitamin E	0.3 mg
Vitamin K	2.6 µg
Minerals	
Calcium	20 mg
Iron	0.25 mg
Magnesium	21 mg
Manganese	0.04 mg
Phosphorus	10 mg
Potassium	182 mg
Sodium	8 mg
Zinc	0.08 mg
Other constituents	
Water	88 g
Lycopene	1828 µg

(**Source:** USDA Nutrients Database)

Cultivation of Papaya Fruits

Papaya plants grow in three sexes: a) male b) female and c) hermaphrodite. The male produces only pollen, never used as a fruit. The female produces small, inedible fruits unless it is pollinated. The hermaphrodite can self-pollinate and its flowers contain both male stamens and female ovaries. Generally, all commercial papaya plants contain only hermaphrodites. Papaya is now cultivated in most tropical countries. First, it is cultivated from southern Mexico and central and northern America. In cultivation, it grows rapidly, fruits grow within 3 years. Papaya is highly frost-sensitive and has a limiting production to tropical climates. It prefers for cultivation in sandy and well-drained soil, as standing water will kill the plant within 24 hours.

Culinary Uses of Papaya Fruits

The papaya ripe fruits are eaten raw without skin or seeds. The unripe green papaya fruits can be eaten cooked and it is used as an ingredient in salad and stews. The black seeds of papaya are also edible and have a sharp and spicy taste. The black seeds of papaya are sometimes ground and used as a substitute for black pepper.

Potential Health Benefits of Papaya Fruits

Age Related Macular Degeneration

Papaya has a various health benefits including asthma prevention and has anti-cancer properties. It contains antioxidant like zeaxanthin, it filters out harmful blue light rays. It plays a protective role in eye health and it may ward off macular degeneration. However, a higher intake of all fruits has been shown to decrease the risk of and progression of age related macular degeneration.

Asthma Disease Prevention

The higher risk of developing asthma is lower in people who consume a high amount of certain nutrients of beta-carotene. These nutrients of beta carotene contained in various foods like papaya, apricots, broccoli, pumpkin and carrots.

Bone Health

Banana fruits contains vitamin K. The low intakes of vitamin K have been associated with a higher risk of bone fracture. Adequate amount of vitamin K consumption is important for good health, as it improves calcium absorption and may reduce urinary excretion of calcium in the body.

Cancer

Consuming of antioxidant beta-carotene, found in papayas, it reduced risk of cancer. Among younger men, higher diets in beta-carotene play a protective role against prostate cancer.

Diabetes

People with type 1 diabetes who consume high-fiber diets have lower blood glucose levels but and people with type 2 diabetes have improved blood sugar, lipid and insulin levels. One small papaya provides about 3 grams of fiber, which is equivalent to about 17 grams of carbohydrates.

Digestion

Papayas fruits contain an enzyme, papain that aids digestion. It can be used as a meat tenderizer. Papaya fruits is also high in fiber and water content, both of which help to prevent constipation and promote regularity and a healthy digestive tract.

Hair Health

Papaya is beneficial for hair because it contains vitamin A, a nutrient required for sebum production, which keeps hair moisturized. Vitamin A is also necessary for the growth of all body tissues, including skin and hair. Consumption of adequate intake of vitamin C, which papaya provides the building and maintenance of collagen and also provides structure to skin.

Heart Disease

Papaya content fiber, potassium and vitamin, all help to ward off heart disease. An increase in potassium level along with a decrease in sodium level is the most important dietary change, it makes to reduce their risk of cardiovascular disease.

Inflammation

Choline is important and versatile nutrient, it found in papayas that aids our bodies in sleep, muscle movement and memory. It helps to maintain the structure of cellular membranes and aids in the transmission of nerve impulses, absorption of fat and reduces the chronic inflammation.

Skin and Healing

Mashed papaya is beneficial for promoting wound healing and preventing infection of burned areas. The proteolytic enzymes such as chymopapain and papain in papaya are responsible for their beneficial effects. Ointments containing the papain enzyme have also used to treat decubitus ulcers.

Conclusion

Papaya is a soft and versatile fruit. It can be incorporated into many recipes. Papaya fruits has a wonderfully soft, butter-like consistency and a deliciously sweet and musky taste. Consuming of papaya fruits, there are various health benefits, it reduced risk of diabetes, heart dieses, cancer, aiding in digestion, reduce blood glucose level, lowering blood pressure and improving wound healing.

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Chapter - 19

Health Benefits of Litchi

Swati Shukla

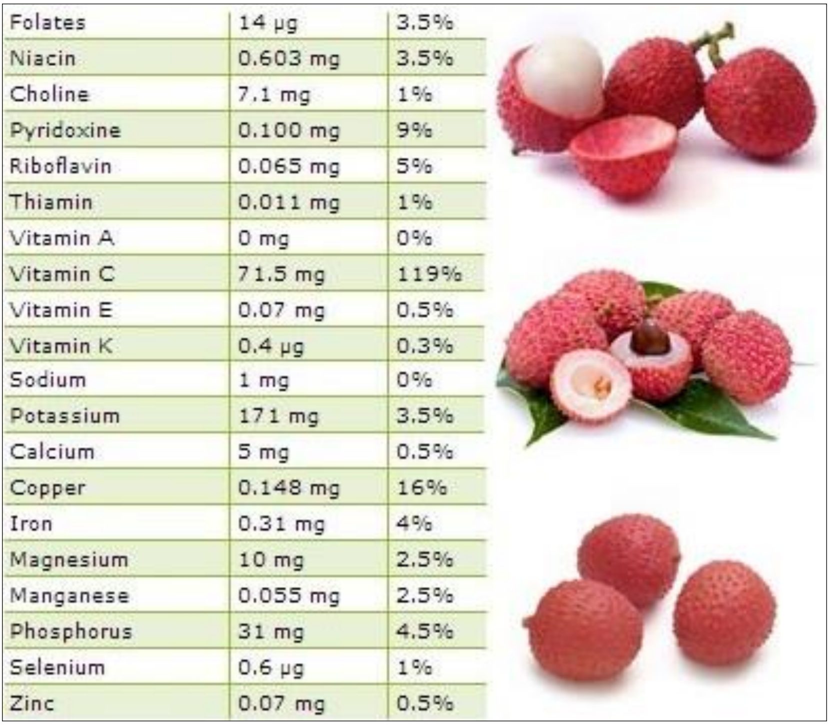
Introduction

Litchi chinensis Sonnerat (also known as Chinese cherry, lychee nut, leechee, etc.) is a fruit tree belonging to Sapindaceae family. It was originally cultivated in China for more than 2300 years and in northern Vietnam. Some cultivars in the west of Guangdong region in China have a long history of cultivation, while others are relatively new. It has been reported that cultivars such as Sum Yee Hong, Haak Yip, Kwai May, No Mai Chee, Wai Chee, and Seong Sue Wai date back to 500 or 600 years or more, while others, such as Bah Lup, Heong Lai and Tim Naan, or Souey Tung are relatively young cultivars (about 100–300 years old). Traditionally, Litchi cultivar characterization was based on morphological studies focused on traits such as floral and fruit characteristics and the harvest season. However, despite Litchi cultivation being diffused in many tropical and sub-tropical regions in the world, this approach is limited because it does not evaluate the interaction of morphological traits with environmental conditions. Only recently, a study was undertaken to identify Litchi cultivars and their genetic relationships using new generation molecular approaches such as single nucleotide polymorphism (SNP) markers. This strategy has allowed for cultivar standardization nomenclature facilitating the integration and interpretation of Litchi germoplasm. Today, Litchi is mainly present in many countries of Southeast Asia, the Indian subcontinent, and South Africa, and in other tropical or sub-tropical areas around the world even if China, India,

Nutritional Value of Litchi

Litchi fruit is rich in carbohydrates and fibers while lipids and proteins are scarce. It is also appreciated for its nutritional properties: in fact the fruit is very rich in nutraceuticals, fundamental compounds with extra health benefits in addition to the basic nutritional value found in foods. Beyond the differences between cultivars of various origins, the beneficial effects of fruits have been partly related to their high contents in micronutrients including vitamins (B1, B2, B3, B6, C, E, K), carotenoids, minerals (potassium, copper, iron, magnesium, phosphorus, calcium, sodium, zinc, manganese, and selenium), and polyphenols, which are highly represented in comparison with other tropical fruits.

Nutritional Value of Litchi per 100 gm



Folates	14 µg	3.5%
Niacin	0.603 mg	3.5%
Choline	7.1 mg	1%
Pyridoxine	0.100 mg	9%
Riboflavin	0.065 mg	5%
Thiamin	0.011 mg	1%
Vitamin A	0 mg	0%
Vitamin C	71.5 mg	119%
Vitamin E	0.07 mg	0.5%
Vitamin K	0.4 µg	0.3%
Sodium	1 mg	0%
Potassium	171 mg	3.5%
Calcium	5 mg	0.5%
Copper	0.148 mg	16%
Iron	0.31 mg	4%
Magnesium	10 mg	2.5%
Manganese	0.055 mg	2.5%
Phosphorus	31 mg	4.5%
Selenium	0.6 µg	1%
Zinc	0.07 mg	0.5%

Fig: Nutritional value of litchi per 100 gm

- **Good for Digestive System**

Litchi is good source of dietary fibre that helps to prevent constipation and also helps to improve digestion. In addition to this, they also stimulate the secretion of gastric and digestive juices, and thus increase the efficiency of nutrients absorption. It provides relief from constipation and also reduces the risk of other gastrointestinal disorders.

- **Wonderful Immunity Booster**

Litchi contain high amount of vitamin C. Vitamin C is a anti oxidant that helps to protect immune system in human body.

- **Reduces the Risk of Various Cancer**

Eating litchi on a regular basis is very beneficial for lessening the risk of different types of cancers. This benefit of litchi is mainly because of the presence of vitamin C in it. Vitamin C is an antioxidant that fights with the free radicals of our body, stabilizes them and thus prevents them from causing oxidative damage to our body cells. By minimizing the risk of oxidative damage, they, in turn, minimizes the risk of various types of cancers. In addition to vitamin C, litchi are also an excellent source of various polyphenolic and proanthocyanidins compounds, which are in fact stronger than vitamin C in reducing the risk of cancer.

- **Provides Antiviral Benefits**

Another important reason to eat litchi for good health is its ability to provide antiviral benefits. Litchis are an excellent source of proanthocyanidin compound “Lithcitannin A2” which has been found to carry antiviral properties and prevent the spread and outbreak of various viruses, including herpes simplex virus and coxsackievirus.

- **Regulates High Blood Pressure**

Regular and moderate consumption of litchi is very beneficial for reducing the risk of high blood pressure or hypertension. This benefit of litchi is mainly because of the presence of high potassium and low sodium level in them. Potassium is a vasodilator which relaxes our blood vessels and ensures smooth blood circulation in our body. When blood vessels are relaxed, blood can flow smoothly, and this automatically drops down the blood vessels. In addition to this, the low sodium level of litchi also plays an important role in regulating our blood pressure level. High blood pressure is known as the silent killer as it stresses our cardiovascular system and increases the risk of heart attack, stroke, irregular heartbeat, etc.

By keeping blood pressure under control, litchi, in turn, helps in keeping our cardiovascular system healthy. It has been found that when it comes to high blood pressure, dried litchis are more beneficial than the fresh litchis as the potassium level found in dried litchis are three times greater than those found in fresh litchis.

- **Good Source of Oligonol**

Litchi is a good source of phenolic compound “Oligonol” in it. This compound have beneficial effects like improves blood circulation, helps in weight loss, protects our skin from harmful UV rays, provides antioxidantal benefits, anti-influenza benefits, etc. The presence of “Oligonol” and the various benefits provided by it is another reason to include litchis in our daily fruit plate.

- **Improves Blood Circulation**

Eating litchis on a regular basis is also beneficial for improving blood circulation level in our body. This benefit of litchi is mainly due to the presence of minerals like copper, iron, magnesium, etc. in them. Both copper and iron play an important role in improving our blood circulation. The Iron present in lychee ensures that the oxygenated blood reaches every cell of our body and it also helps in reducing the risk of anemia and other diseases caused by the deficiency of iron. Similarly, the copper present in litchi plays an integral role in the formation of red blood cells, and thus boost blood circulation. In addition to the iron and copper, litchi is also an excellent source of magnesium, manganese, folate, vitamin C, etc. and these compounds also play a significant role in improving our blood circulation.

- **Promotes Cardiovascular Health**

Regular and moderate consumption of litchi is beneficial for our heart too and helps in keeping our cardiovascular system healthy. The cardiovascular benefits provided by litchis are mainly because of the presence of antioxidants, phenolic compounds, potassium, Oligonol, and dietary fiber, etc. in them. The antioxidant (Vitamin C) present in litchis fights with the free radicals of our body stabilizes them and thus prevents them from causing oxidative damage to our body. In addition to this, potassium present in litchis relaxes our blood vessels, regulates blood pressure and thus reduces the stress on our cardiovascular system. In addition to this, litchis are also a good source of “Oligonol” which promotes the production of Nitric oxide (NO). Nitric oxide is a vasodilator that relaxes our blood vessels and arteries and thus reduces the risk of cardiovascular problems like heart attack, stroke, irregular heartbeat, etc. Additionally, the flavonoids and the dietary fibers present in litchis also play a significant role in keeping our cardiovascular system healthy.

- **Prevents Cataract**

Regular and moderate consumption of lychees is good for our eyes as they reduce the risk of cataracts. This benefit of lychee is mainly due to the presence of antioxidants like vitamin C in it. These antioxidants fight with the free radicals of our body stabilizes them and thus prevents them from causing oxidative damage to our cells. By minimizing the ill effects of oxidative damage, lychees reduce the risk of cataract; age-related macular degeneration, etc.

- **Acts Against Influenza**

Eating litchis on a regular basis is very beneficial against influenza. This benefit of litchi is mainly due to the antiviral property of litchi. The "Oligonol" present in litchi stops the virus from multiplying and thus fights against influenza.

- **Disease Fighting Flavonoids**

Another important reason to make litchi a part of our fruit plate is the presence of flavonoids in them. These flavonoids provide antioxidant benefits and reduce the risk of cardiovascular problems and various cancers. In addition to this, itchiss are also a good source of the powerful antioxidant named "quercetin" which also provides anti-inflammatory benefits.

- **Provides Antioxidantal Benefits**

Lychees are a good source of vitamin C which is an antioxidant that provides a lot of benefits.

They fight with the free radicals of our body, stabilize them and prevent them from causing oxidative damage to our body cells. By preventing our body cells from oxidative damage, they reduce the risk of various types of cancers and also provide other benefits like keeping premature aging at bay, strengthening our immune system, minimizing the risk of cataract, improving the cardiovascular system, etc. They are also good for our cognitive health and reduce the risk of Parkinson's disease and Alzheimer's disease. The antioxidant benefits provided by litchi are another major reason for eating litchis on a regular basis.

- **Excellent Source of Rutin**

Litchis are a good source of various polyphenols and one of them is "Rutin". This bioflavonoid is well known for improving the strength of our blood vessels. Because of this benefit, they are often used for varicose veins, hemorrhoids and as well as bruising. Deficiency of bioflavonoid may weaken our blood vessels and make them prone to break easily. Eating litchis on a regular basis strengthens our blood vessels and minimizes the risk of getting bruised easily.

- **Provides Anti-Inflammatory Benefits**

Litchis are an excellent source of vitamin C which is an antioxidant that also provides anti-inflammatory benefits. Because of the anti-inflammatory nature of litchis, they are found to be very beneficial in providing relief from inflammatory diseases like arthritis, gouts, etc. Eating litchis on a regular and moderate basis has been found to be beneficial not only in relieving inflammation but also in controlling it. Litchis are also good for relieving the inflammation and tissue damage caused by the high-intensity exercise and training.

Conclusion

Litchi fruit contain key bioactive compounds that account for the anticancer effects. Purifying these agents may represent an important step in phyto-pharmacotherapy, which can have a high impact in oncology. However, the biological activity of Litchi components has been mainly studied as evaluation of cytotoxicity in in-vitro models. Therefore, the knowledge of the biochemical mechanisms underlying the anti-proliferative/death effects of Litchi components in tumor cells represents an important basis for anticancer translational studies. Litchi contains high percentage of dietary fibre that helps to control constipation, obesity and diabetes mellitus problem. Litchi also contains vitamin C, so litchis are good source of antioxidant.

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Chapter - 20

Fruits for Vocal Health

Santanu Tewari

Water is present in the human body about 60% of the total body weight. We should intake approximately two quarts of water (or liquid) per day to function properly. Every system in the body depends on water.

Water regulates body temperatures, eliminates toxins, carries nutrients and oxygen to the cells, and provides a moist environment for body tissues and joints. Fruits contain large quantities of water in proportion to their weight. When fruits are eaten, the water can be absorbed by the body.

Fruits containing large amounts of water are excellent hydration-conscious snacks, including apples, pears, watermelon, peaches, melons, grapes, blueberries, oranges, pineapples, plums and raspberries. These fruits are good source of water that helps to keep lubricated the vocal cords.

Vocal Cord

The vocal cord, is also known as vocal fold, is fold of tissue in the throat that are key in creating sound through vocalization. The size of vocal cord affects the pitch of voice. Open when breathing and vibrating for speech or singing, the fold is controlled via the recurrent laryngeal branch of the vagus nerve.

They are composed of twin in foldings of mucous membrane stretched horizontally, from back to front, across the larynx. They vibrate, modulating the flow of air being expelled from the lungs during phonation.

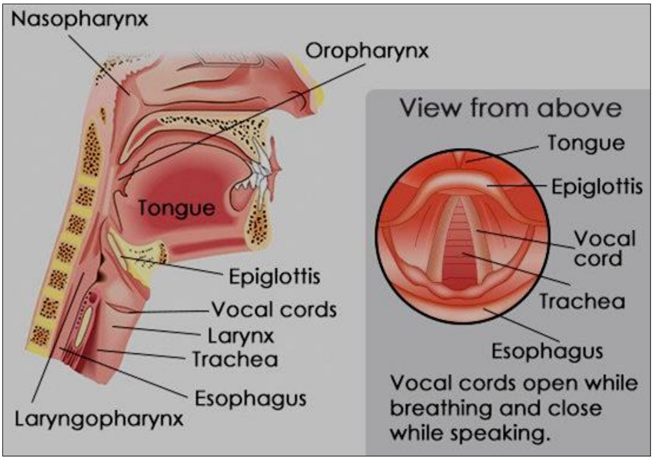

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Fig 1: Vocal Cords

Structure of Vocal Cords

The vocal cords are composed of twin in foldings of 3 distinct tissues: The outer layer is squamous, non-keratinizing epithelium. Below this is the superficial layer of the lamina propria, a gel like layer, which allows the vocal fold to vibrate and produce sound. The vocalis and thyroarytenoid muscles make up the deepest portion. These vocal folds are covered with a mucous membrane and are stretched horizontally, from back to front, across the larynx.

The vocal folds are located within the larynx at the top of the trachea. They are attached posteriorly to the arytenoid cartilages, and anteriorly to the thyroid cartilage. They are part of the glottis which includes the rima glottidis. Their outer edges are attached to muscle in the larynx while their inner edges, or margins, are free forming the opening called the rima glottidis. They are constructed from epithelium, but they have a few muscle fibres in them, namely the vocalis muscle which tightens the front part of the ligament near to the thyroid cartilage. They are flat triangular bands and are pearly white in color. Above both sides of the glottis are the two *vestibular folds* or *false vocal folds* which have a small sac between them.

Situated above the larynx, the epiglottis acts as a flap which closes off the trachea during the act of swallowing to direct food into the esophagus. If food or liquid does enter the trachea and contacts the vocal folds it causes a cough reflex to expel the matter in order to prevent pulmonary aspiration.

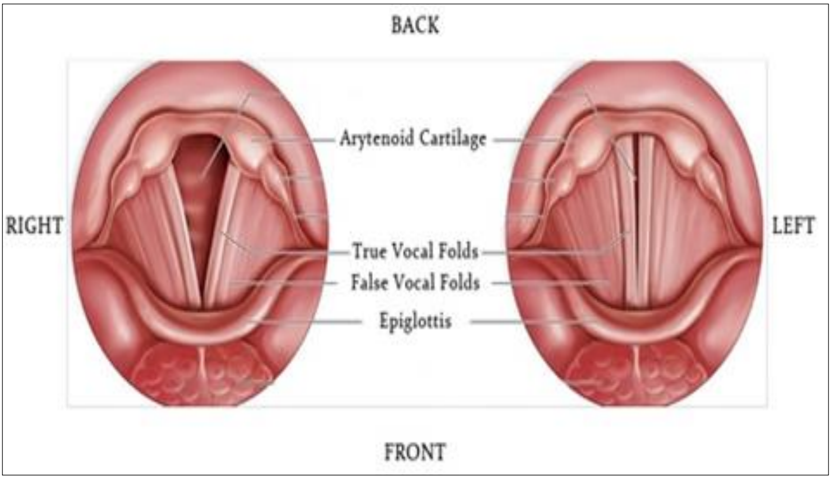

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Fig 2: Structure of vocal cords

Fruits for Vocal Health

Most of the fruits contain high amount of vitamin C and potassium that is beneficial for vocal health.

- **Vitamin C for Vocal Health**

All fruits contain high or low amount of vitamin C that is beneficial for voice health and also helps to clean the mucus of the vocal cords and soothe the *voice.*

- **Potassium and Sodium for Vocal Health**

Potassium is the predominant positively charged electrolyte in body cells. The flow of potassium and sodium in and out of cells maintains the normal functioning of the vocal cord and vocal muscles. Potassium is important for muscle contraction. Most of the fruits like Bananas, oranges, cantaloupe, honeydew, apricots, and grapefruit (some dried fruits, such as prunes, raisins, and dates) contain high amount of potassium.

- **Antioxidant and Anti-Inflammatory Activity of Fruits for Vocal Health**

Mainly all berries have antioxidant and anti inflammatory properties, that also beneficial for vocal heath. Diet rich in antioxidants and anti-inflammatory fruit can help protect vocal cords.

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